August 1982

Smithsonian

In Wonderland, Alice confronts the Caterpillar onstage at Minneapolis' Children's Theatre (p.52)

A collection of twelve hand-painted figurines, each an original work of art in fine imported porcelain.

Examine them closely and you can almost sense a quivering heartbeat beneath their colorful plumage. So lifelike are *The Songbirds of America*, they seem to pulsate with life itself! They appear capable at any moment of breaking into glorious song, or cocking their heads to catch a better glimpse of you, or bursting into flight the instant you draw too near!

A Magnificent Tribute to One of America's Richest Natural Treasures — Her Songbirds

If you love beauty and effortless grace . . . if you love bright, joyous colors and the loveliest of melodies, *then you must love songbirds*. Wrapped in these pretty little packages are so many of the qualities we admire in nature. Indeed, these cheerful little creatures bring endless hours of joy and amusement to millions of birdlovers. Who doesn't love to watch them splash and play in a backyard birdbath, or wing through the wilds the very picture of freedom!

And now twelve of America's most beloved songbirds will be painstakingly sculpted and then individually painted *by hand* in fine imported porcelain. Only a fortunate few will ever own these beautiful original works of art.

Marvels of Authenticity

Porcelain figurines are an exceptionally demanding art form, requiring absolute accuracy in *three* dimensions instead of just two, as in a painting. Hence it is significant that these museum-quality figurines are models of ornithological fidelity. They capture in astonishingly lifelike detail every nuance of color . . . the delicate formations of beak, wing and tail . . . even the intricate cross-thatching of multiple layers of feathers!

Further enhancing their realism, each bird is poised in a setting from its natural habitat. Notice the tree bark, for example. It's almost difficult to believe it's not real wood! This is because every little notch and ridge in the bark has been *sculpted* into the ceramic mold itself, and not just *painted* on the finished piece. Moreover, meticulously hand-applied brush strokes have shaded the wood lighter and darker in various places — to capture the look of tree bark just as you find it in the forest!

This painstaking craftsmanship also extends to the flowers which beautifully adorn each bark. Look at these and you will see that each flower blushes prettily with a *variety* of lovely shades. *This is porcelain artistry at its finest!*

12 Beautiful Birds

Here in all its brightly-feathered finery is the sleek crested *Cedar Waxwing*, whose wing feathers are tipped with glossy red, as though touched by sealing wax. Here, too, is the flamboyant *Cardinal*, sporting a red suit and black mask, as if attired for a gala masquerade ball.

Lift here ▶

The Songbirds of America

Cedar Waxwing

Figurine above shown actual size.

Carolina Chickadee

Cardinal

RESERVATION APPLICATION

D13

The Songbirds of America

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47 Richards Avenue
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I need send no money now. The collection will be issued at the rate of one figurine every two months. I will pay for each figurine as billed in two convenient monthly installments of $27.50 each. Any figurine I am not completely satisfied with may be returned upon receipt for replacement or refund, and this subscription may be cancelled by either party at any time.

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Allow 8 to 12 weeks after payment for initial shipment.

Adding his dazzling charm to the collection is the black and orange *Baltimore Oriole,* described by one ornithologist as "a living gem intended to decorate the verdant garment of the new-clad forest." Not to be overlooked is the *Western Meadowlark*, whose rich, flutelike melody brings a familiar song of cheer to countless farmhouses and country homes throughout America's prairie and mountain states. Here also is everyone's favorite harbinger of spring, *Robin* red-breast, looking somewhat like a little banker in his brick-red vest and charcoal gray coat. And there are seven others, just as enchanting!

An Exceptional Value

The photographs shown, beautiful as they are, cannot compare with the actual figurines. Moreover, these sculptures have an authenticity and intricacy of detail simply not visible in figurines commonly found in stores. Figurines of comparable quality, when available at all, range in price from $90 to $125. Yet *The Songbirds of America* are available to you for only $55 each. This exceptionally low price is made possible by the economics of this convenient, direct-by-mail offer, where

Robin

Western Meadowlark

Baltimore Oriole

Figurines above shown much smaller than actual sizes which range from 4¾" to 6¾" in height.

"middleman" costs are eliminated and the savings are passed along to you.

An Exclusive Edition

To enhance the collection's importance, *The Songbirds of America* will be available exclusively from the Danbury Mint. No figurines will be available in even the finest stores; they cannot be obtained anywhere else except through this special direct-by-mail offer. For production planning purposes we ask that your order be postmarked no later than October 31, 1982.

Your Satisfaction Guaranteed

Each figurine in the collection will be carefully inspected, but, more importantly, each must be acceptable to *you*. Hence, if you are not completely satisfied, you may return any figurine upon receipt for replacement or refund. And you may cancel your subscription at any time.

Convenient Monthly Installments

You can reserve *The Songbirds of America* by completing the attached reservation application. The twelve figurines will be issued at the rate of one every two months. There is no need to send money now. You will be billed for each figurine in two convenient monthly installments of $27.50 each, or you may charge each installment to your VISA or MasterCard.

Act Promptly to Avoid Disappointment

As you look at these photographs you can begin to imagine how beautiful the figurines will appear in your home. They are a stunning complement to any decor and instantly turn any room into a breathtaking gallery of fine porcelain sculpture. Imagine what compliments they will win from family and friends!

Please respond now if you wish to be among the relative few whose homes will become a privileged sanctuary for these beloved songbirds. They are the "crown jewels" of America's rich natural wildlife, and they will adorn your home with a gaiety, charm and beauty few other collectibles can match. Reserve your collection today!

August 1982

Smithsonian

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IN THE LAND THAT PRODUCED THE WALLABY, WOMBAT, EMU AND KANGAROO, YOU'D HARDLY EXPECT TO FIND AN ORDINARY VACATION.

Nothing is what you expect it to be in Australia.

The cute little teddy bear, the koala, isn't a bear at all. He's a marsupial, like his cousins the wallaby and kangaroo. We have a bird, the emu, that can outrun a racehorse. And another, the fairy penguin, that can swim underwater at over 30 miles an hour but can't fly any higher than he can jump.

Even our London Bridge, the one you see here, was being carved out of rock by the sea while the other London was still a cluster of huts on the Thames.

So where do you begin to explore this large and diverse a country? You begin, of course, with the people.

WE'LL GREET YOU WITH OPEN ARMS, NOT OPEN HANDS.

From the moment your Air New Zealand 747 Super B touches down in Sydney, you'll be amazed at the Australian people's sheer zest for living. Perhaps you'll be invited to enjoy a schooner of beer in a picturesque pub in The Rocks, site of the original English penal colony settlement. And when it's your turn to "shout a round" it'll be easy, because when it comes to having fun, the Aussies speak the same language you do.

Naturally some shopping, gallery hopping and an evening at the fabulous Sydney Opera House are de rigueur, and you'll have to sample at least a few of Sydney's fabulous (and often surprisingly inexpensive) restaurants.

But the countryside beckons and how better to see the real Australia than on a working sheep station? You can visit for a day or become a member of the family and stay as long as you like.

Wherever you go in Australia, you'll find the greeting warm and genuine and the open hands you'll see are for shaking, not for tipping.

THE WORLD'S LARGEST REEF AND LONGEST BEACH.

Australia's coastline is not all beach, it just seems that way. There are nearly fifty beaches within easy reach of Sydney and Melbourne alone. And if you tire of strolling on one of them, how about taking a walk on the Great Barrier Reef?

Right, a walk. At low tide, all you need to explore this fabulous coral reef off Australia's northeast coast is a pair of tennis shoes and a bathing suit.

But perhaps you'd rather explore for something more valuable. How about gold? Australia had a gold rush like California's and parts of the historical gold country still exist. You can pan for gold in streams that are far from "played out," and everything you find is yours to keep.

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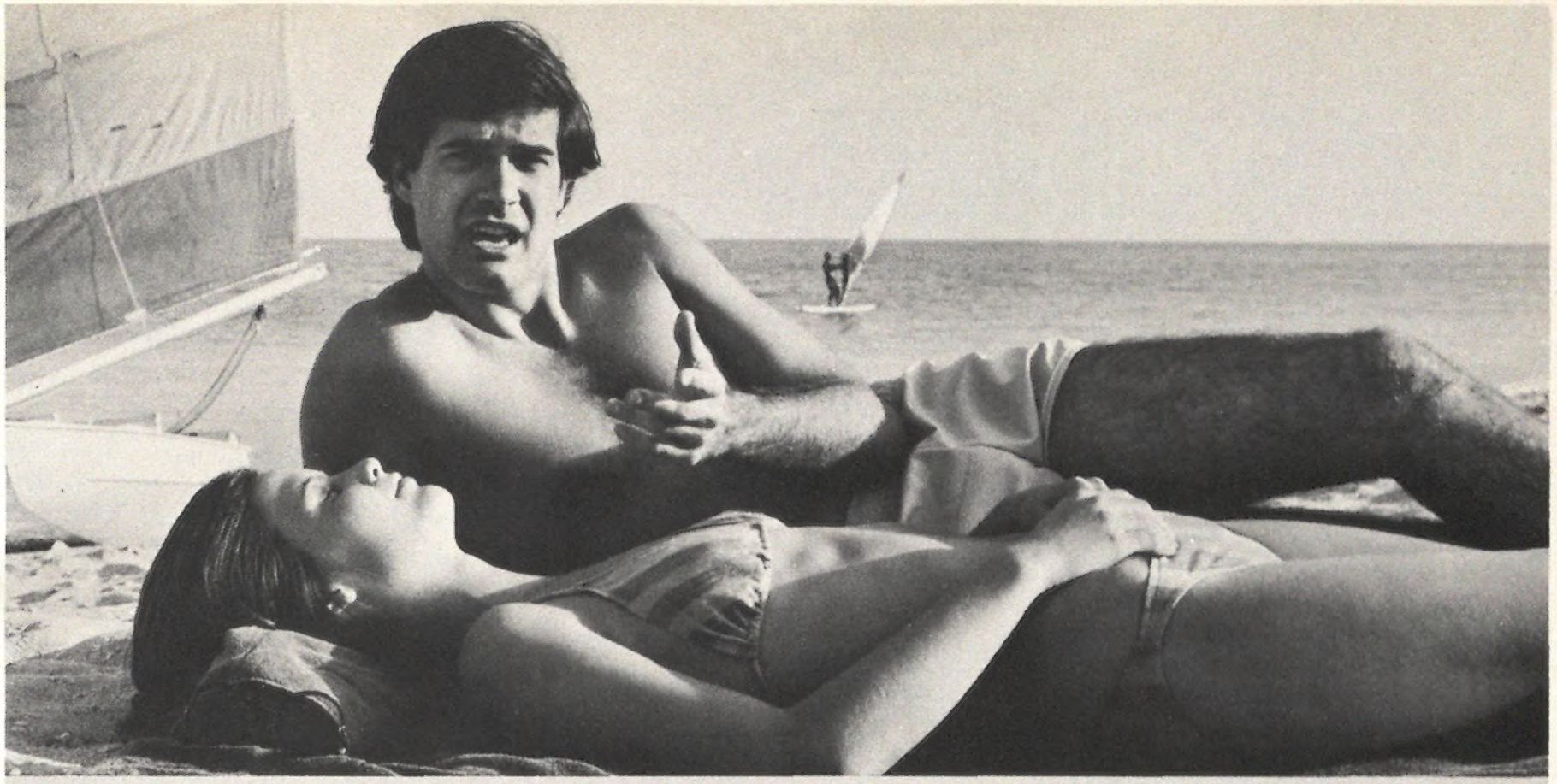

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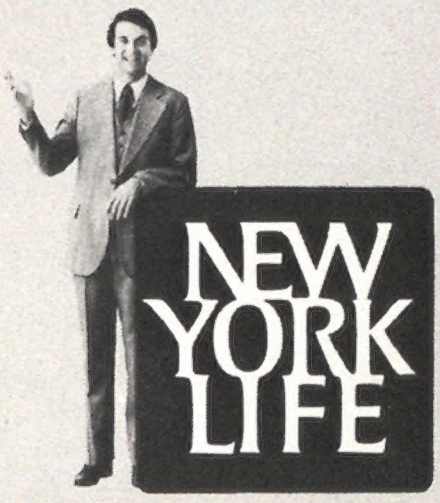

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The view from the castle

In the ten years between Stockholm and Nairobi, more developing nations have seen the need for environmental monitoring

Ten years ago I had the honor of attending as a member of the U.S. delegation the first United Nations Conference on the Human Environment in Stockholm. I wrote hopefully about the experience (SMITHSONIAN, August 1972), although as an ecologist and biologist by profession I was dismayed by the unfamiliarity of many delegates with the principles of ecology itself. Despite that, ecology had already become a fashionable word, used with confident authority by economists, politicians, lawyers and others whose principal outdoor experiences, as I said, tended to be "confined to crabgrass, the golf course or a day at the beach."

Now in 1982 there is an official United Nations Environment Programme (UNEP), headquartered in Nairobi, Kenya. The United States this year contributed $7.85 million to the program, although there is a possibility the amount may go down next year. Some 100 nations have just attended a meeting in Nairobi to mark the tenth anniversary of Stockholm, and to assess progress and plan for the future of the fragile envelope within which we live.

In 1972 many of the developing nations seemed to feel that concern for the environment was a subtle "imperialist plot." For instance, by limiting trade in goods and services that might be pollution producers, the industrialized nations could maintain an economic advantage over emerging countries. I recall the prime minister of a Third World nation saying to me, "Give us your smog. We want to eat it to make us rich!"

Now at this latest conference in Nairobi it was evident that many developing nations are well aware of the need for control and long-range restraint on simple exploitation. Brazil was a prime example ten years ago of resistance to calls for conservation. But by the mid-1970s Brazil had established an environmental office within the Interior Ministry. Paulo Nogueira Neto, chief of this division, has just been given, along with Maria Tereza Jorge Padua, the World Wildlife Fund's respected annual conservation prize, the $50,000 J. Paul Getty award.

Still, there is a persistent feeling in our country that not only is "all right with the world," but that mankind has made it so. As the Hudson Institute (1982) recently put it, "The idea that progress is normal has been prevalent since the beginning of the Industrial Revolution." The concept that technology will always rescue us from the consequences of our own skills and inventiveness is pervasive. Human ills today are largely a result of a simple mathematical process, the geometrical progression of human population growth. Ecologically speaking, this will be exceedingly difficult to arrest. Here, perhaps, there are answers in technology, but they will be spiritually trying indeed, and perhaps totally unacceptable to many.

Our own government leaders would be wise to keep up the relatively inexpensive funding of UNEP, not only as "an ounce of prevention" but also as part of a ground swell of public opinion which it would be a mistake to ignore. Where ten years ago we might have been thought of as having imperialist designs on the poorer nations by preaching conservation, now we would be one of the "good guys" if we pushed it.

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Road & Track thinks
"could be the finest car in the world."

Dankeschön, Road & Track Magazine.*

Rarely, if ever, has a car arrived from Europe with the acclaim as that bestowed upon this newest Audi.

The 1983 Audi Quattro demonstrates how far enlightened technology can go when Bavaria's great engineers are given the freedom to build a car like this.

By any standard, the Quattro is one of the world's most advanced high-performance GT Sports Coupes.

The Quattro's unique system of four-wheel drive, turbocharged five-cylinder engine, five-speed transmission, four-wheel independent suspension and low-drag aerodynamics establishes new parameters in automotive design.

Audi's revolutionary all-wheel drive represents the most significant breakthrough in recent automotive technology. To drive this truly exciting automobile today is to know what it may be like to drive the automobile of the coming decades.

Ironically, the Quattro arrives in America at a time when virtually every car maker worldwide is frantically redesigning cars *en masse* to incorporate "innovative" front-wheel drive systems.

In truth, it was Audi that pioneered front-wheel drive more than 50 years ago, long before it became a fashionable marketing expedient.

As a result of this considerable head start in drive-system technology, Audi is clearly ahead with its exclusive all-wheel drive concept.

Unlike ordinary "off-road" four-wheel drives, the Quattro's drive train is a sophisticated system designed for maximum "on-road" efficiency.

At the heart of this system is a third differential, located behind the transmission. It distributes power evenly between the front and rear wheels.

The benefits of having the front wheels pulling and the rear wheels pushing simultaneously are numerous. The Quattro delivers remarkable performance in cornering, straight-ahead driving and even in climbing steep, snowy hills.

Because of its all-wheel traction, the Quattro has a hill-climbing factor of 1.75 to 2.10, which means it is far superior to many of today's generation of cars.

The Quattro's tractive forces and response give it outstanding acceleration and speed. Wheel lockup while braking is much less likely; steering response remains neutral through on-off throttle changes; and the tendency to aquaplane is greatly minimized.

Stunning first-year victories in four World Championship Rallyes in Europe have quickly borne witness to the merits of this new Audi technology.

The Quattro is powered by Audi's five-cylinder turbocharged engine, with CIS fuel injection.

It provides 160 horsepower, giving the Quattro fast sprint times: 0 to 50 in 5.3 seconds, and the quarter mile in 15.7 seconds, and a top speed of 128 miles an hour.

Its highway passing prowess illustrates the engine's strength and elasticity. In fourth gear, the Quattro can go from 35 miles an hour to 62 miles an hour in just 9.6 seconds.

Into this remarkable powerplant, Audi engineers have built many advanced features. For example, an intercooler, that is normally found only in exotic racing cars. It is a small radiator that can cool the turbocharged intake air by 40°-50° centigrade, thereby providing greater density for improved horsepower.

Notable, too, are the notched pistons in the engine. This allows for engine oil to be sprayed onto the bottom of each piston for added cooling.

The Quattro also introduces a compact, five-speed transaxle. Its design makes possible a ground clearance of only 5.3 inches for excellent aerodynamics with a low center of gravity.

As extraordinary as the Quattro is, it is like every Audi in its dedication to the newest ideas in technology and the craftsmanship of its Bavarian coachmakers.

The 5000 Turbo, the new 5000 Turbo Diesel, the GT Coupe and the 4000 Sports Sedan have all been recognized in the automotive community for their advanced engineering ideas.

Indeed, the Quattro is the definitive statement for high-performance automobiles of this decade and a milestone in the art of engineering.

For your nearest Porsche Audi dealer, or details on the Audi Delivery in Europe Program, call toll free (800) 447-4700. In Illinois, call (800) 322-4400. © 1982 Porsche Audi

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Letters to the Editor

Bangkok's anniversary

Dear Sir: I wish Roger Warner's account in your June issue had included a remarkable American, Dan Beach Bradley, a medical missionary in Bangkok from 1835 to 1873. He is credited with the introduction to Siam of surgery and vaccination. His was the first newspaper to be published there, and he printed the first Royal Proclamation—against the sale of opium—to come off a press in Bangkok.
Donald Wilson
Randolph, New Hampshire

Dear Sir: Prince Mahidol, father of King Bhumibol, and I were fellow students at Harvard Medical School, class of 1928. He was 10 or 12 years older than most of us, a warm and friendly man and an able and devoted student, always ready to serve beyond the call of duty—I remember him volunteering promptly to take over night hospital duty from a student who was ill.

He came late to the study of medicine. Like all the royal Thai princes, he had been sent to a foreign court—in his case the Imperial German Court before the First World War. He was well into his 30s before he was free to follow his personal bent and study medicine. Prince Mahidol's aim was to bring modern pediatrics to Thailand; his early death was a serious loss to his country. An exceptional man, he well deserves to be remembered.
John T. Edsall, M.D.
Cambridge, Massachusetts

Mauritius

Dear Sir: Alison Jolly's article is a testament to the disregard mankind has for any life outside its own. This island, supporting the final numbers of so many species, is a prelude to what lies down the road for the rest of this small world.
Rob Chartier
Seaside, California

Duck stamps

Dear Sir: Any objection to the black Labrador with duck in mouth is absurd. This stamp was for a very good purpose—to impress on wildfowl hunters the importance of a dog in retrieving cripples. Many wounded birds fall into a marsh or out of reach in the sea. So, without his retriever the hunter continues to shoot until he has bagged his legal limit, leaving the cripples to die beyond reach.
George H. Earle IV
Reading, Vermont

Puzzling Smullyan

Dear Sir: Ethan and Violet Russell are described as a couple, and, since they share the same last name, it would seem likely that at some time in the past, one must have asked the other the usual "Will you marry me?" Because the answer was apparently "Yes," we know that the asked was a type A. If either of them is an A, then the answer to Ethan's question, "Are Violet and I both of type B?" has to be "No," thus showing that Ethan is a B and Violet is the A. The real concern here, of course, is that they should have discussed their alphabetical orientations and preferences prior to the wedding.
B. Freer Freeman
Falls Church, Virginia
Mr. Smullyan replies: "According to what you say, it must have been Violet who proposed marriage to Ethan. I say that it was Ethan who proposed to Violet, not by asking 'Will you marry me?' but by asking 'Am I the type who could ask you whether you will marry me?' Without even knowing what type Ethan is, it follows that Violet will marry him. (For proof, see solution 14, page 76, in my The Lady or the Tiger?)." Ed.

Mall

Dear Sir: Fay Gillis Wells' account of parachuting from a falling plane in 1929 brought back a vivid memory. I was only four years old when I must have seen that

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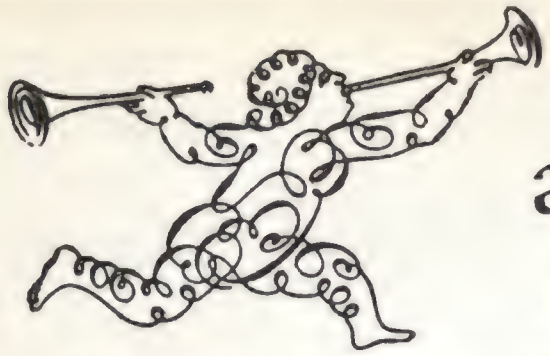

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very plane falling out of the sky and into the Valley Stream woods near our home. It took confirmation by the neighbors before my parents would believe I hadn't imagined it. Then they took me to the woods, and I remember seeing a man and a woman being rescued from the treetops by firemen with long ladders.

Following this incident I would dash into the house whenever a plane flew over—fortunately, in 1929 there were not too many—terrified that one would fall onto my head. My wise father devised a clever way to rid me of my phobia. At the breakfast table he picked up the newspaper and read aloud an imaginary article stating that a new type of parachute would open and prevent a troubled plane from falling. Of course, I believed it.
Marjorie C. Sagman
Longboat Key, Florida

It was indeed Fay Gillis and pilot "Sunny" Trunk whom four-year-old Marjorie Rothschild saw being rescued from the treetops. "I'd have probably broken both my legs but for the great good luck of coming down into the trees," Fay Gillis Wells says, "because I had no idea how to land with a parachute. Both of us wound up in the same cluster of trees right off the end of the airport." Ed.

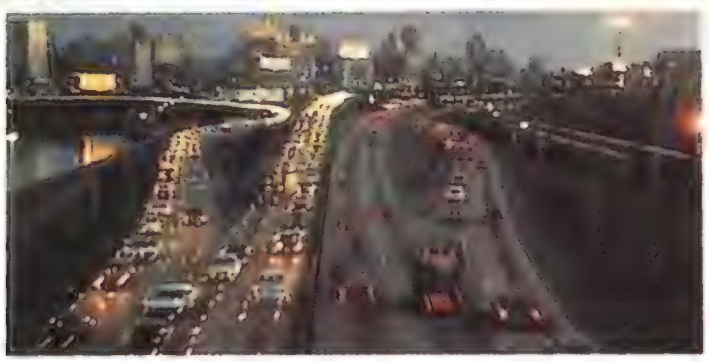
Dear Sir: I enjoyed Mr. Park's article on Amelia Earhart, but would like to enter a couple of corrections: the western part of Roosevelt Field is now a large, modern shopping center; Roosevelt Raceway occupies the eastern part. And the first meeting of the Ninety-Nines took place at Curtiss Field, Valley Stream, Long Island, 12 miles from Roosevelt Field.
William K. Kaiser, Curator
Cradle of Aviation Museum
Garden City, New York

Phenomena

Dear Sir: In reference to Mr. Wiley's discussion of environmentalists Rachel Carson and Barbara Ward, may I suggest that not only does Jonathan Schell's *The Fate of the Earth* pick up where these writers left off, but he carries the ball much farther into the realms of philosophy, psychology and cosmology.

I call your attention to the following excerpt: "The nuclear peril is usually seen in isolation from threats to other forms of life and their ecosystems, but in

Remember when "Boom Town" was just a movie?



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fact should be seen as the very center of the ecological crisis. . . . Both the effort to preserve the environment and the effort to save the species from extinction by nuclear arms would be enriched and strengthened by this recognition. The nuclear question, which now stands in eerie seclusion from the rest of life, would gain a context, and the ecological movement, which, in its concern for plants and animals, at times assumes an almost misanthropic posture, as though man were an unwanted intruder in an otherwise unblemished natural world, would gain the humanistic intent that should stand at the heart of its concern."
Robert S. Levy
Upper Nyack, New York

Book reviews

Dear Sir: Something is wrong with the chronology in Michael Olmert's review of *The Watercolours and Drawings of Thomas Bewick*. How could a work of Sir Edwin Landseer's have formed the basis for Bewick's 1789 wood block *The Chillingham Bull*? Landseer was born in 1802. Was it spirit work by mediums?
Lisa McDavid
Greeneville, Tennessee
No mediums, not even a soothsayer. Bewick drew his own original for The Chillingham Bull. *Among his friends was John Landseer, an engraver and writer and Sir Edwin's father.* Ed.

'Gorilla warfare'

Dear Sir: As an educator, I would like to respond to Lillian Stewart Carl's facetious account of her experiences as a teacher.

We professionals are aware that many very serious problems related to teaching and learning underlie such spelling weaknesses as those she described. These problems include not only those diagnosed as student "learning disabilities," but also questions of elementary-teacher competence, dubious techniques employed in the teaching of reading, and a host of other factors described in Bruno Bettelheim's recent book, *On Learning to Read* (SMITHSONIAN, May 1982).
Marie Barry, PhD
Washington, D.C.

Dear Sir: In grading bar examinations for nine years as a member of the Board of Law Examiners for Kansas, I ran into the exact same problems with law students.

The reason students cannot express themselves in writing is that TV is oral, and loquacity has no logicality.
Paul L. Wilbert
Pittsburg, Kansas

Dear Sir: As a librarian and ten-year veteran of the English classroom, I often wonder why we teach. It isn't for the prestige; there is none. It isn't for the pay. It isn't for the bonuses; there are few. It certainly isn't for the satisfaction.

Perhaps it is because of the one or two who show interest, respect, progress and promise. Perhaps it is the hope that someone will wake up and quit sending students to high school who don't know how to read the textbooks, or the hope that the publishing companies will quit watering down the material so that it will be once more on high school level. Perhaps we hope that parents will turn off the TVs and battery-powered games and encourage the use of brain-powered play.
Betty Woodard
Deltaville, Virginia

Letters

Dear Sir: In 1908 the Prince of Wales, who succeeded to the throne in 1910, had no grandchildren. His oldest child, Prince Edward (later Edward VIII and then Duke of Windsor) was only 14. Was it the Prince of Wales' father, King Edward VII, an indulgent grandparent by all accounts, who wanted his grandchildren to see the start of the Marathon?
Ajay Mathur
Chicago
The Princess of Wales suggested starting the race at Windsor Castle for the benefit of the royal grandchildren. Ed.

Origins

Dear Sir: A footnote to Mr. Olmert's article on legends surrounding clothing:

We all know about Yankee Doodle's having "Stuck a feather in his cap/and called it macaroni." In late 18th- and early 19th-century England a group of men—the hippies of their day—affected outlandish dress patterned after Italian contemporaries. It seems clear that Yankee Doodle, in copying them, was not trying to compliment the British.
Donald L. Bevis
Hollywood, California

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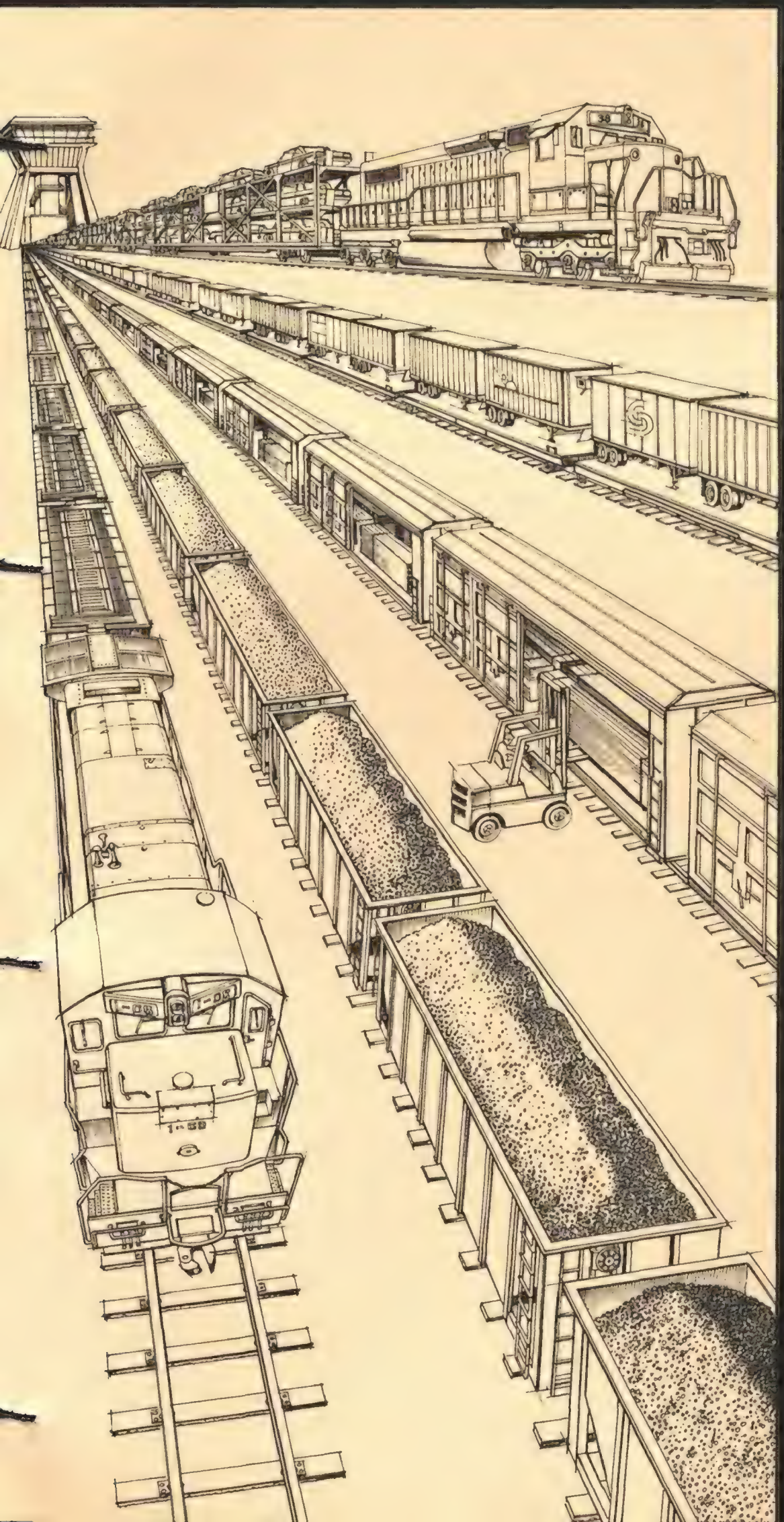

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Around the Mall and beyond

It looked like a World War I machine-gun nest at, say, Verdun. Soggy sandbags ringed a pool of viscous gray water, which, just beneath the surface, gelled into thin mud. A foot down, this texture became a seemingly bottomless boot-sucking clay. If you walked in it, you risked vanishing. When you wrenched your way out of it, pounds of Mother Earth remained with you, weighting every step.

At Verdun, this wretched mire might well have contained the bones of a soldier. Here, too, it contained bones. But this was not Verdun. This was a construction site a few miles outside the District of Columbia, and these were the bones of a mammoth, that early form of elephant, extinct for about 10,000 years.

On several bleak days last March the gray mudhole swarmed with Smithsonian and U.S. Geological Survey scientists, university professors, students, volunteers and interested hard-hats from the construction company. They staggered in the mud, losing boots as well as dignity. They sweated to fill with mud the burlap sacks that served to divert the stream that washed through the site. They struggled to set up a proper grid of staked lines so that a semblance of organization could be maintained in the sliding, shifting mess. They swore and they grunted and they sometimes simply laughed in total helplessness. But at the heart of the activity a couple of slime-smeared experts brushed away water and very gently, with painstaking care, probed for bones and removed them.

The reason for the care, the explanation for the whole mammoth caper, was that along the Eastern Seaboard of the United States, mammoth bones don't show up every day—or every decade, for that matter. "If this was South Dakota," said Dennis Stanford (below), glaring around with mud on his beard, "no one would have been impressed."

Stanford, the Smithsonian anthropologist who cut up an elephant named Ginsberg with flint and bone knives (SMITHSONIAN, July 1978), seeks to establish the time of Man's habitation on this continent through the evidence of the tools he used—including the knives and spearpoints with which he killed and butchered his meat. Some of the meat was certainly mammoth. So Dennis was one of the first scientists to be alerted to the Maryland find.

A geology student at the University of Maryland University College made the discovery. Dana M. D'Aria needed to make up a field trip for his class. Like many fellow students, he knew about the construction site, where bulldozers had canalized underground streamlets into a straight drainage channel. Along the banks of this cut, the clay sandwiched a dark streak, an Upper Cretaceous stratum where shells and sharks' teeth could easily be found. D'Aria headed for it on a Sunday afternoon to get some specimens.

There were other students and amateur diggers in the area. Dana moved away from them, braving the wet mud of the channel bottom. He spotted a curved

Dennis Stanford holds rib from mired mammoth. Finder D'Aria (left) looks on.

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stick jutting from a murky pool. He pulled it out. It was regularly curved, rather heavy, smooth. Not wood. It was a bone. A rib, in fact.

Dana said he thought it might belong to a cow. He continued working along the stream bed. Then "cow" just didn't seem right to him. He went back to the puddle where he'd found the bone and sloshed around a little more.

This time he felt, and pulled out, another hefty piece of bone, thick, rounded. And he knew it had to be part of a tusk. And the animal had to be a mammoth.

D'Aria squelched his way to a telephone, tried to call the Smithsonian, failed because we all goof off on Sundays, finally called his professor. It speaks well of Dana's scholarship that Peter Kranz, after understandable expressions of disbelief and upon viewing some of the bones that evening, agreed with his identification. Dr. Kranz notified people at the Museum of Natural History. Dennis Stanford agreed to take charge of the hastily mobilized "expedition." Gary Haynes, a Smithsonian research associate, came to back up Dennis and do the actual excavating of the bones. Other volunteers enlisted for the duration. The contractors readily agreed to the excavation and offered help. The owners of the projected industrial park, McCormick Properties, Inc., added their full cooperation.

So on a miserable morning the mammoth mob mobilized. Dennis made it clear that secrecy would be maintained lest the dig be overrun in a "mammoth rush." He also drafted every soul who was not actually taking pictures. Those sandbags had to be filled.

For an hour I tried to fake the mumbo jumbo of photography—sighting, adjusting apertures, mumbling about depth of field, shaping rectangles with my hands. Then I was found out and slapped into a work gang. I levered up dripping shovelfuls of muck and dumped them into bags held open by a muscular and imperturbable young lady—a creature, obviously, of today. No Vassar girl would have done that work in *my* day.

For all of us, every step was a sickening plunge followed by a gut-wrenching hoist of what felt like a 50-pound boot. My pitiful physical resources were soon spent and I let my teammate do the work of two.

While we militia churned the mud, Drs. Stanford and Haynes and others of the high command went after the bones. Two construction workers, stopping by during a coffee break, were amused at the delicacy with which the bones were removed. "Hell, man," said one to the other, "I could get them bones outa there in ten seconds flat with a 'dozer. Just one run. We'd scoop up ever one of them bones." A volunteer archaeologist winced.

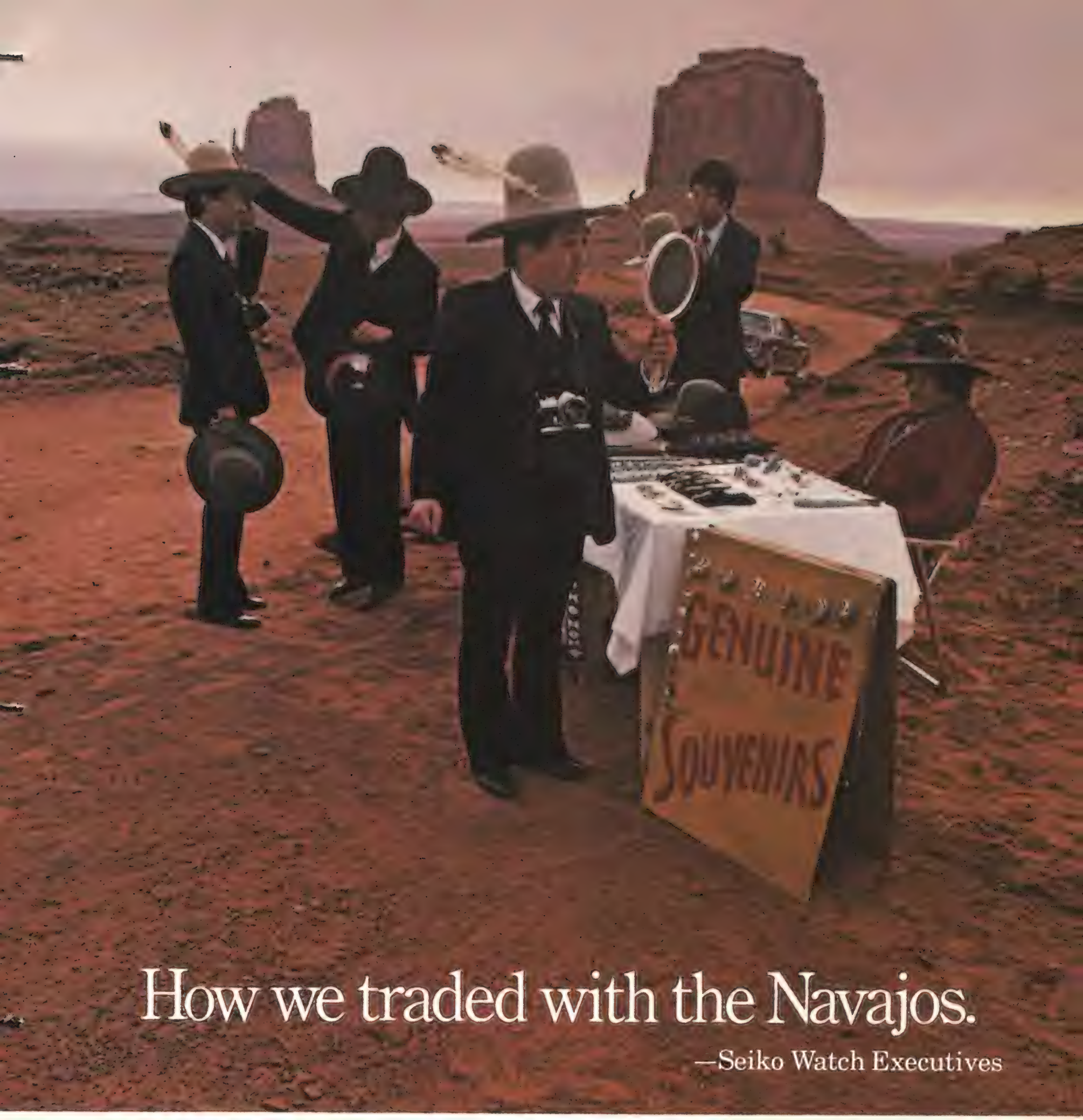
Quite possibly a bulldozer had already scooped up some of the bones. For though this mammoth was unusually complete, fragments of only one leg bone were found. Perhaps the other legs had been scraped away when the drainage canal was dug. Or—and this thought never fails to intrigue Stanford—was early Man somehow responsible?

An estimated 200 bones and bone fragments were removed. I saw long pieces of rib and darkened vertebrae lurking under the surface of the pool like rocks. There were also pieces of tusk, the entire lower jaw, half the pelvis, one shoulder blade and lots of skull fragments. The scientists agreed that the mammoth was about three-quarters grown—a "teen-ager," perhaps ten feet tall.

One of the bones was put through the carbon-dating process at the Smithsonian's Radiation Biology Laboratory outside Washington. The age appeared to be 20,070 years, plus or minus 265. That, says Dennis, predates the generally accepted earliest date for Man in America. (Bone carbon dating is apt to be less accurate than wood carbon dating. The latest news is that the sediments—containing twigs, roots, grass—among which these bone fragments lay show an age of 29,650 years, plus or minus 750.)

Gary Haynes has been studying the sediments and pollens around the find and reports that at the time of the mammoth's death, the surrounding site may have supported the kind of vegetation—spruce, pine—that is now typical of colder, more northerly areas. Dennis Stanford feels that this vegetation would not have been entirely suitable for a mammoth; better for a mastodon.

There was some puzzlement over the finding of Late Pleistocene bones so near a Cretaceous layer. Gary says the indications are that a stream bed cut into the underlying Cretaceous stratum and reworked it. He learned that the land had been farmed for years. The spot where the mammoth bones were found had been



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a low spot in a corn field, a swale between two rises. A track or footpath running between house and barn appears to have crossed the swale at just about the point where the mammoth was found.

The farm seems to have had no particular historic significance. Apparently two elderly sisters at one time lived there in two houses, among barns and outbuildings. They moved away and it seems that squatters moved in. The construction crew characterized the squatters as "hippies," but Gary points out that they might describe him and Dennis as hippies, too.

There's no record of another mammoth find at the farm. However, the discovery of a mammoth leg bone near Upper Marlboro, Maryland—only a few miles from the present mammoth site—was described in 1911. This bone was given to Georgetown University and, according to the people there, was displayed at their Coleman Museum for a spell. Then, says Georgetown, when the Coleman Museum closed some 40 years ago, it was passed along to the Smithsonian—at least that's what the Georgetown people think.

The trouble is, records of the acquisition by the Smithsonian don't seem to exist. Embarrassing as it may be, somewhere along the line the leg bone of a mammoth seems to have been . . . shall we say "misfiled"? Everyone knows the Smithsonian doesn't "lose" anything. But, in cold truth, the dear old Institution and surely prestigious old Georgetown University can get a little bewildered about the exact location of some item that has never been fed into computerized inventories. Hell, I guess *anyone* could misplace a mammoth bone now and then.

Other mammoth finds were made in the area. Talbot County, Maryland, on the Eastern Shore of Chesapeake Bay, apparently yielded teeth, a tusk and some other mammoth bones in 1869. Interestingly, more mammoth teeth were later found only a mile away.

Teeth and bone fragments have been added to the Museum of Natural History's collections over the years. But Dennis Stanford's and Gary Haynes' bones, or more properly Dana D'Aria's, and officially McCormick Properties', are the first remains of a single, identifiable mammoth ever obtained for the Smithsonian. So far, no human artifacts have shown up in connection with it.

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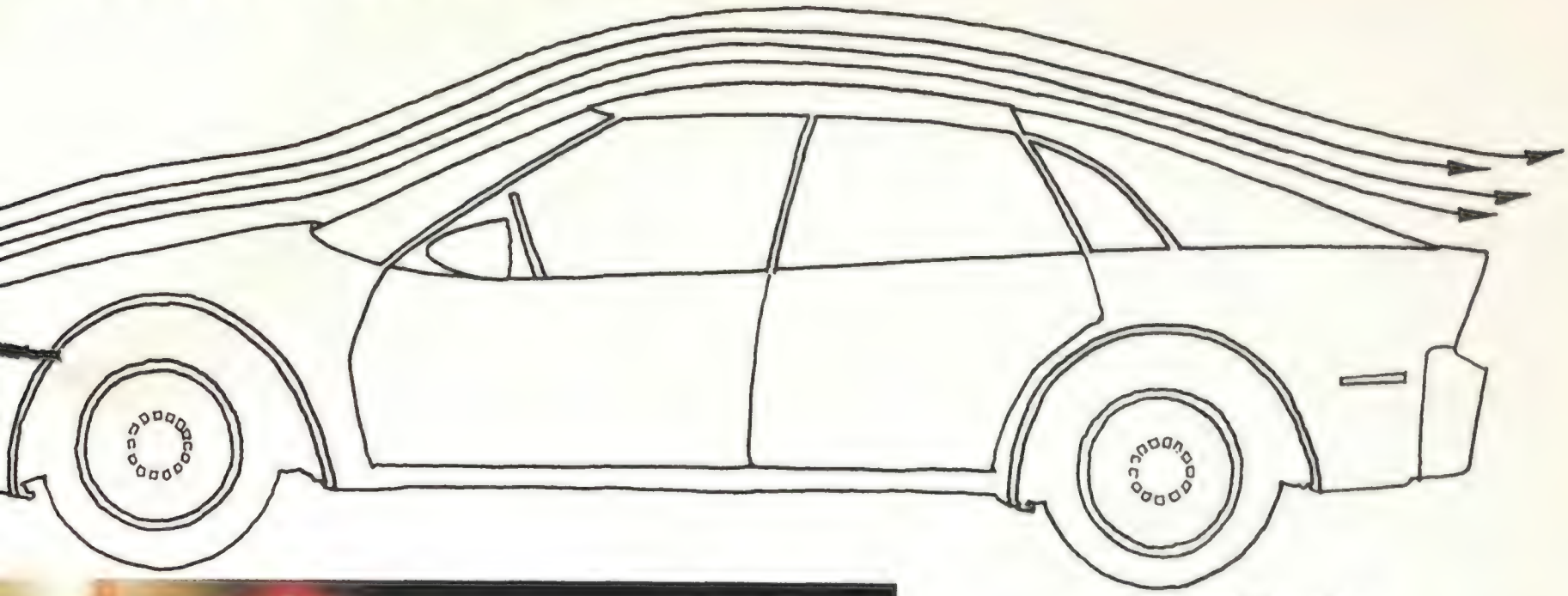

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Phenomena, comment and notes

For scientists who want to study anomalous phenomena, new society offers a respectable framework

Scientists have two problems when they think about the unthinkable. It can be as difficult for them as it is for the rest of us to break out of conventional lines of thought. And if they do come up with something beyond the pale, it can damage their careers if they express it. The astronomer who thinks that something alien could be flying around in our atmosphere, the zoologist who thinks large organisms may live in Loch Ness, the engineer who suspects some people can affect physical objects with their minds, all know they had best be quiet. To publish could well be to perish.

With good reason, the scientific community tries to protect itself from madness and nonsense, from charlatans and promoters (so do magazine editors, with equally good reason). But it is not always easy to distinguish between a genuine anomaly and a hysterical story in a supermarket tabloid. Two centuries ago, after all, the French Academy refused to consider that meteorites fell from the sky. Heresy, in the sense of a departure from dominant opinion, is not always wrong. In fact, it seems downright unscientific to pronounce some phenomenon to be nonsense without looking into it.

A small band of intrepid (the word is truly apt) scientists and other scholars are trying to do something about it. Just 100 years after a group of prestigious British scientists founded the Society for Psychical Research (which has since numbered among its presidents three Nobel Laureates, ten Fellows of the Royal Society and one Prime Minister), 38 men and women spent a rainy weekend at the University of Maryland for the first meeting of the Society for Scientific Exploration.

The idea is to provide a forum for the working scientist who wants to investigate anything outside the normal disciplines, be it ball lightning (p. 28) or precognitive remote viewing. Only established scientists with proven records will be admitted as members; some 100 had joined even before a letter announcing the society appeared in *Science*, and another 130 applications were pending as the meeting got under way.

The society hopes to give both the phenomenon under study and the scientist a fair shake. The organizer and first president is Peter Sturrock, an astrophysicist and director of the Institute for Plasma Research at Stanford University. His interest dates from the Condon Report, a two-year study of UFOs funded by the U.S. Air Force and headed by a former director of the National Bureau of Standards. Sturrock said he read the whole report and realized that the conclusions did not follow from the case histories. He found it "curious" that scientists, either on hearsay or after reading the first few pages, assumed that the matter was settled. "This is not the way science usually works," he lamented.

Five years ago Sturrock polled his own professional group, the American Astronomical Society. Nearly one in five members had seen something in the sky he could not explain, and four in five expressed a willingness to help resolve the UFO problem. (Only ten percent, however, could see any way they might conceivably help.) Following that poll, Sturrock discussed the need for a society with a number of people, which finally led to the society's first meeting, held on the same floor with an entomologists' dinner and a cello congress.

To study something scientifically you have to know what that means, and Henry Bauer, dean of arts and sciences at Virginia Polytechnic Institute and State University, opened the meeting by pointing out that few people can agree on a definition. "Scientific" cannot mean controlled experimentation in astronomy or even field biology; it is not always quantitative in geology or biology; and frequently it is not even empirical as experimenters discard data that do not seem to fit. (I had always thought you were not supposed to say that last in public, but nobody seemed to flinch.)

Bauer contended that the word is most

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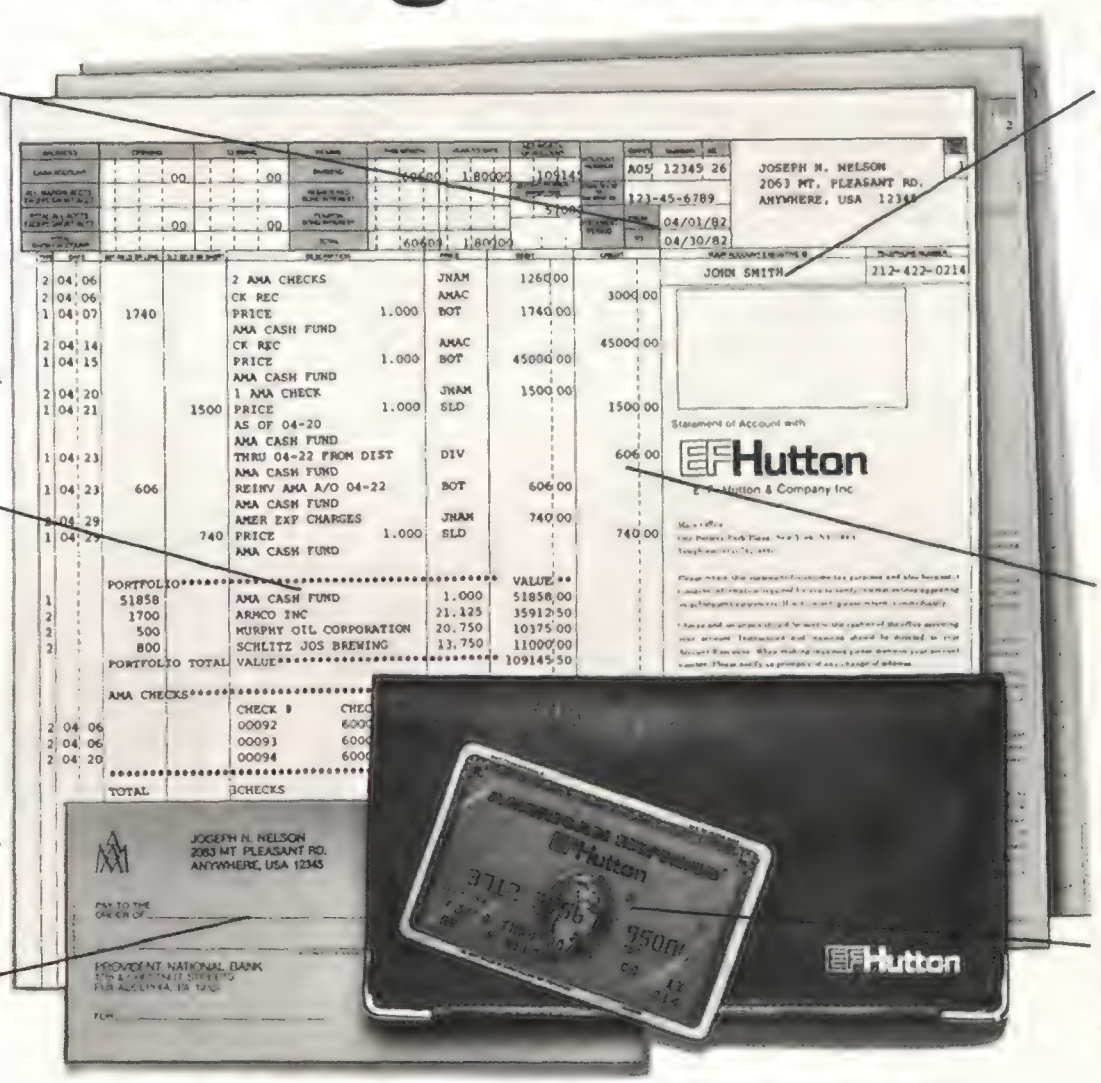

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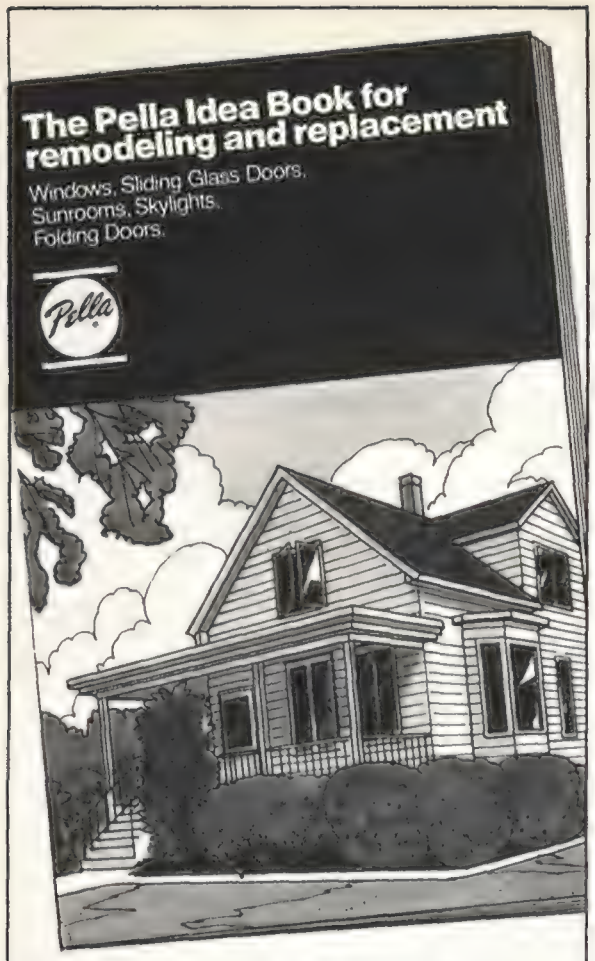

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often used rhetorically, to signify either power over nature or simply truth. But he argued that although until the mid-19th century scientific knowledge had been equated with certain truth, since then scientists and philosophers had gone their separate ways. They communicated so little, Bauer said, that scientists generally do not know that philosophers no longer make that equation.

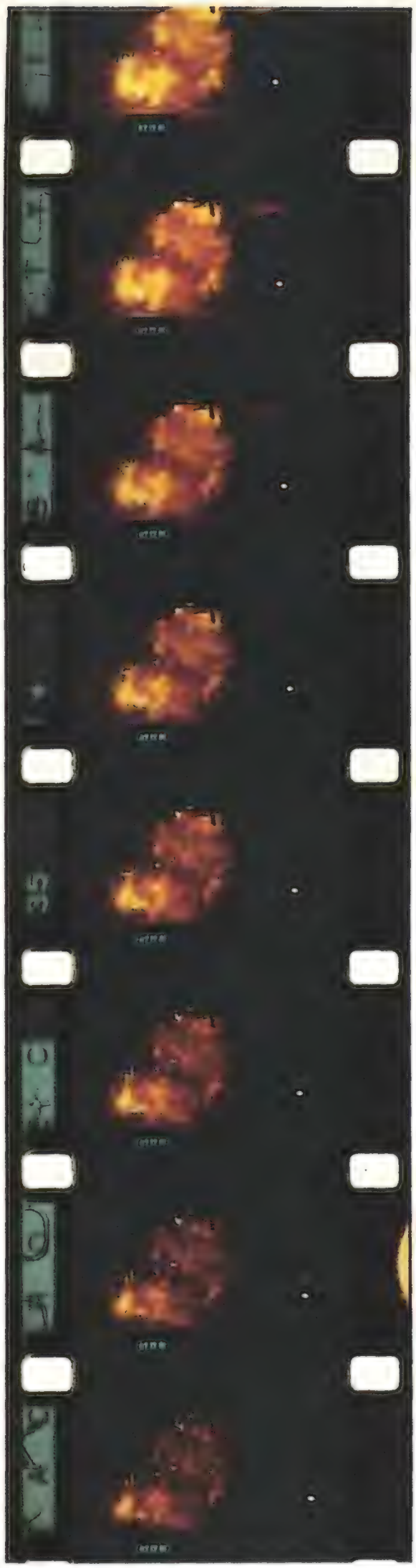
Even if we do cobble up a general definition of scientific method, Bauer went on, that is not what scientists actually do. Any such definition would include ideas like careful, cautious, repetitive, but the scientists we admire most are those who are creative, daring, surprising and elegant.

The scientific method really comes into play only as the whole institution absorbs the discovery of the individual scientist, he suggested. The communal judging and testing of the individual's work leads to the science that is independent of the scientist's style. It is just this communal aspect that the new society will offer. Members will investigate areas in which the facts themselves are in dispute, but they will bring established techniques and theories to bear, employing the virtues that helped turn earlier protosciences like astrology and alchemy into the sciences of astronomy and chemistry.

Equipment may even be already in place. Ralph Markson, a pilot and an atmospheric scientist at MIT, said he thought the whole question of UFOs could be settled in two years. Air-traffic-control radar and military radar blanket almost the entire country. If UFOs are solid objects, they will register. All that is needed is a mandate to the Federal Aviation Administration and the military to pay attention to anomalous blips.

Established techniques are already being applied, of course. Bruce Maccabee, director of the Fund for UFO Research, offered a painfully detailed analysis of a film shot from a plane flying along the New Zealand coast on the morning of December 31, 1978, showing the proverbial lighted shape in the sky. He certainly convinced me that it could not be a Japanese fishing boat strung with lights to attract squid, apparently the last surviving conventional explanation, but I'm hardly competent to comment.

The real showstopper came from the dean of engineering and applied sciences



White dot moving to right in successive frames (top to bottom) may be ball lightning formed in electrical discharge at left during Los Alamos experiment.

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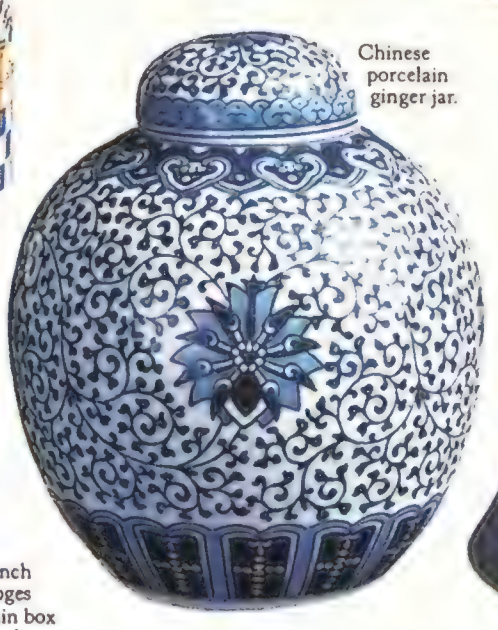

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at Princeton University, who reported on some studies of psychic phenomena that had the physicists whistling in admiration of the techniques. Robert G. Jahn has devoted his life to aerospace engineering. Five years ago he permitted an undergraduate in electrical engineering and computer science to supervise a study of psychic phenomena as her independent research project. He was bemused, he said, and persuaded it was a legitimate field for a high technologist to study.

The most impressive of Jahn's results had to do with low-level psychokinesis, in which an "operator" tried to affect a very delicate electrical, mechanical or thermal process—something physical—with his or her mind alone. In one set of experiments, they used an electronic device that generated positive or negative pulses randomly. Jahn called it an "electronic coin flipper." To make sure the pattern was random, the group had run 25,000 trials. Then an operator was invited to affect the results of sets of 200 coin flips each. What so impressed the physicists was that each operator was put through as many as 12,000 trials. Twenty percent of the operators did affect the results, on the order of one flip in a thousand. A minute effect, but the sheer number of trials carried its own weight. The probability of the actual result was three parts in a billion.

In other experiments, operators changed the temperature of one of a pair of thermistors, altered the light patterns made by wavelength-measuring devices, or influenced the number of balls falling into certain bins in a device resembling a pinball machine. The consensus seemed to be that Jahn's group was measuring something, although what that might be nobody could say.

I'm certainly not saying that the New Zealand light was a flying saucer or that Jahn's volunteers could affect an electronic coin toss. More to the point, neither is the Society for Scientific Exploration. The forum's the thing; results will stand or fall by themselves.

A secondary goal of the society organizers is to serve as a clearinghouse for reports of anomalous phenomena. Seemingly inexplicable incidents or observations that go unreported will perforce go uninvestigated. Even if the society opens itself up to a flood of mistakes, misunderstandings and out-and-out hoaxes, its officers feel, the chance to find something real makes the policy worthwhile.

Sociologist Ron Westrum of Eastern Michigan University, associate director of the Center for Scientific Anomalies Research, offered an example of how reporting revealed a real phenomenon. Presumably there have always been some parents who have injured their children, but the battered-child syndrome was not medically recognized until after the Second World War. The first major paper, published in 1946, listed six cases. A survey of hospitals and district attorneys published in 1962 found 749 cases. By 1976, the number of reported cases had passed the 500,000 mark.

Westrum went too far, however, even for the Society for Scientific Exploration, when he turned to "spontaneous human combustion," cases in which exactly that supposedly happens. He talked seriously about the reluctance of the appropriate officials to report such events, but embarrassed titters and groans from the audience made it clear this topic was a little too much.

What happens now? A membership directory will list members' interests, should a funding agency or journal need an appropriate referee. Sociologist David W. Swift of the University of Hawaii will edit a newsletter. Westrum will put together a reading list on the whole subject of scientific anomalies. The society will meet again next June at the University of Virginia in Charlottesville. And in 1984, Vol. 1, No. 1 of its journal will appear.

The society is not likely to make headlines, and fervently hopes not to. Presumably the end result of most investigations will be a null: nothing there. But the members, and we, will have the satisfaction of knowing the phenomenon in question had a fair trial. That's the best any of us can expect.

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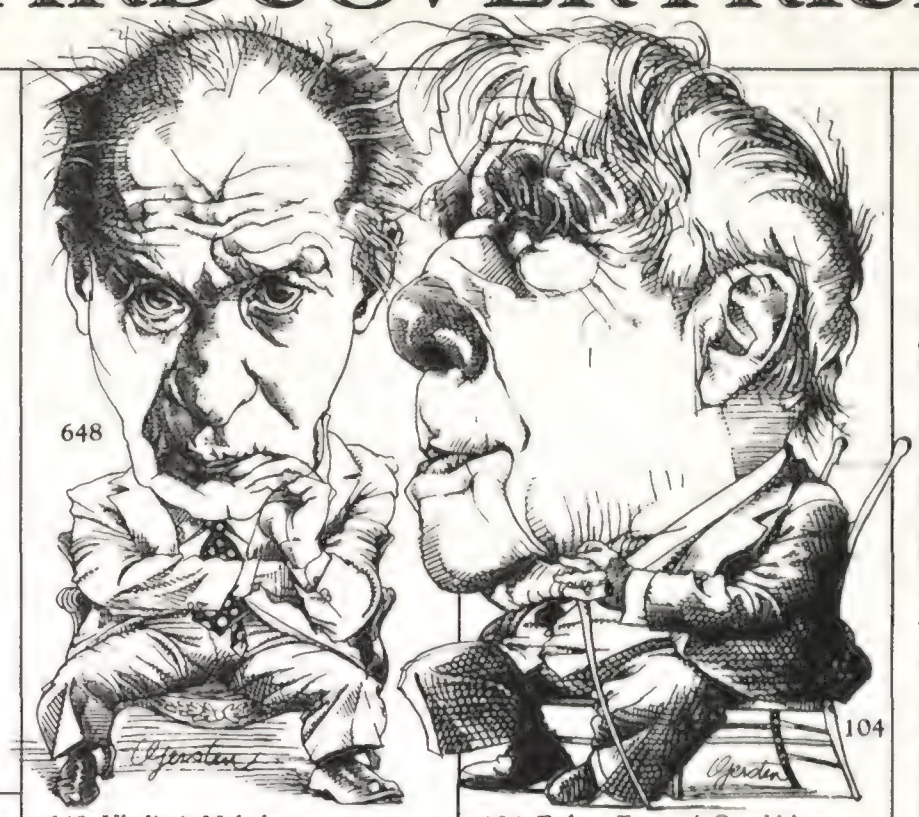

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Lot B. Page, M.D.:

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An authoritative report on how much salt intake may matter to you if excessive . . . and how much good moderation can do . . . by a preeminent expert who, literally, has gone almost to the ends of the earth to find out.

PUBLISHER'S NOTE: *Chief of Medicine at the Newton-Wellesley Hospital and Professor of Medicine at Tufts University School of Medicine, Boston, Dr. Lot B. Page has been called "the preeminent scholar in this field (hypertension) in the United States; in fact, in the world." His studies of high blood pressure and what influences it have taken him on medical expeditions to many places abroad, including the Solomon Islands, to investigate pre-industrial populations. He has also studied nomads in the deserts of Iran. We have asked him to assess hypertension and its importance, the factors that influence it, the role of salt in elevating blood pressure, and how much you may gain by examining the salty side of your life.*

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Points of origin

A lively storehouse of our language's history and use, Oxford English Dictionary *took 54 years to complete*

In Oxford Scriptorium, editor James Murray works on *Dictionary*, 1915.

On January 18, 1884, at the Clarendon Press, Oxford, appeared the first volume of a work that has become the indispensable tool of writers and wordsmiths, scholars, critics and the congenitally curious for nearly a century. The work's title page proclaimed it as *A New English Dictionary on a Historical Basis,* of which this was to be the first part, covering "A" through "Ant-." Truly, this was a modest start for a project that appeared at the same time as *Huckleberry Finn,* Brahm's Symphony No. 3 and Rodin's *The Burghers of Calais.*

The "Historical Basis" noted in the title is what aroused so much interest in the work and what keeps it alive today. That means each word is not only described in all of its meanings, but is also presented in its original context, with a line or two for poetry, a phrase or sentence for prose. Further, the listing for each sense is continued, through time, from the first appearance of the word in the English language to the close of the 19th century.

For example, the dictionary begins with the first English use of the word "A," in its meaning as a letter of the alphabet. It appeared around the year 1340, in a poem called "The Pricke of Conscience" by the English mystical writer Richard Rolle of Hampole. The text presents the belief that you can determine a newborn's sex by the sound of its first cry:

> If it be man it says a!a!,
> That the first letter is of the name
> of our forme-fader Adam.
> And if the child a woman be,
> When it is born it says e!e!
> E. is the first letter and the head
> Of the name of Eve. . . .

Here is no bland start for the dictionary but a riveting one, reflecting an ancient custom obviously promulgated by nervous fathers outside the birthing chambers. The entry continues with other significant uses for the letter "A"—Chaucer in 1386, Samuel Butler in 1678, Tennyson in 1842.

Each such entry in the dictionary—known today as the *Oxford English Dictionary,* or more simply the *OED*—gives, in addition to the year and author, the quoted work's title and a line or page reference, so the interested reader can fill out the complete context of the passage (although it takes a rather full library).

Actually the need for such a dictionary had been seriously discussed since 1857, when the work was first sponsored by Britain's fledgling Philological Society and its early director, F. J. Furnivall. Right off, Furnivall recognized the importance of having reliable texts for the dictionary's quotations and so founded the Early English Text Society in 1864 (which is still publishing more than a century later) and the Chaucer Society in 1868 (now moved to America and the University of Oklahoma in Norman).

But a projected work of this scale needed a full-time editor and, by degrees, the job was turned over to a 42-year-old schoolmaster, James A. H. Murray, in 1879. Murray (left) directed the project until his death in 1915. Still, the *OED* was not complete until April 1928, when the last section, "Wise" through "Wyzen," was printed (an easier task, "XYZ," had been completed in October 1921). A catchall supplementary volume for words missed the first time round appeared in 1933.

The continuity alone is impressive—54 years of production and 44 years of continuous publication. It is rumored that one of the Oxford University Press compositors set nothing else in type for the whole of his working life. Murray himself gave 38 years of labor to the dictionary and was knighted for his trouble—and achievement—in 1908.

One reason the *OED* is so valuable to us today is that so much unalloyed hard work went into its production. Under the direction of the indefatigable Murray and his editorial staff at Oxford, a corps of readers from around the globe undertook to read the entire body of English literature, as well as legal and historical documents, private papers, tracts and other ephemera. Five million such excerpts were collected on thin slips of paper that constantly engulfed the staff; about 1.8 million of those quotations appear in print. The result is a 12-volume work of 15,487 oversize pages, nearly half of them written by Murray.

And, oh, what you can do with those pages, where the outcome is so much more than just looking up words! Take as a test case my favorite passage in the films of W. C. Fields. There is a point in *The Bank Dick* where Fields' patience wears thin and he is forced to scowl at his great lummox of a prospective son-in-law (played to insouciant perfection by Grady Sutton): "Don't be a mooncalf. Don't be a jobbernowl. You're not one of those, are you?" Mooncalf. Jobbernowl. We can hear in Fields' intonation that those are terms of derision, but what is their linguistic heritage? Who first capitalized on their load of derisive meaning?

Jobbernowl, the *OED* advises us, signifies "a blockish or stupid head; a ludicrous term for the head, usually connoting stupidity." Its first use was in 1599, when John Marston used it in his collection of verse satires called *The Scourge of Villanie.* There, he characterized the very

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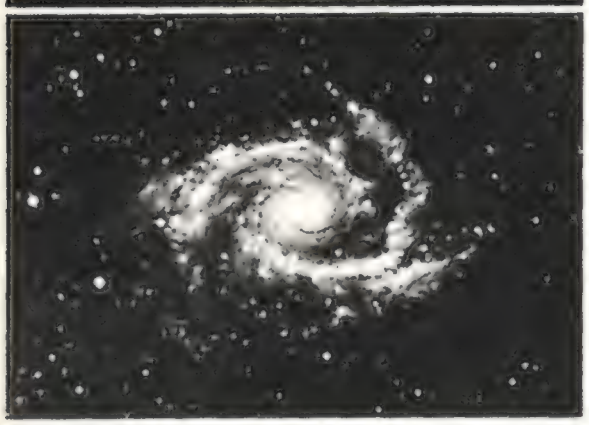

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type of a phony poet, the simpleton ballad maker whose "guts are in his brains, huge Jobbernoul,/Right gurnet's-head; the rest without all soul." Gurnet's-head, we learn elsewhere in the *OED*, is a term of contempt, used with reference to the disproportionate head of a certain fish, the gurnard (of the genus *Trigla*, typically with a large spiny head and armored cheeks).

And mooncalf? Shakespeare used it in Act II of *The Tempest* (1611) to mean a misshapen child, a monstrosity, as was his character Caliban: "How now, mooncalf!" Shakespeare's contemporary Ben Jonson used it in a play of 1620 to signify a born fool: "Moone Calves! what Monster is that . . .?/ Monster? none at all; a very familiar thing, like our foole here on earth." The extension of the word's meaning to suggest one who gazes at the moon, a "mooning," absentminded person, was made by Thomas Middleton in his 1613 play, *No Wit like Woman's*: "One Weatherwise . . . Observes the full and change [of the moon], an arrant moon-calf."

The great advantage of the *OED*, of course, is that it shows, dramatically, how some words have been transformed from their former meanings. Pedagogue, for example, originally meant a type of Roman slave who accompanied patrician youths on their walks to school each day. The *OED* derives the word from Greek roots meaning "child-leader." Yet the original pedagogues were in no sense leaders or tutors, but merely escorts who drilled the children as they walked and who often sat in on the day's classes in a vain attempt to improve themselves. Such men became boring, moralistic, platitudinous dolts. In the *OED* entries, one can watch the early use of the English word connoting contempt and hostility (1735: "Cow'd by the ruling Rod, and haughty Frowns of Pedagogues severe"), watered down to the point in comparatively recent times when some educators would actually seek to have the practice of education called "pedagogy."

Conversely, the *OED* can make us feel good about the way we use our language. It is comforting to see that the word "decimate," a derivation from the Roman custom of executing every tenth man in a mutinous legion (and a current bête noire of popular commentators on "the decline of the English language," who claim we use the word too loosely) has

in fact been very loosely applied since the beginning. In the 17th century, Oliver Cromwell "decimated" the Royalist Cavaliers, the losers in the Great Civil War, merely by forcing them to give up a tenth of their estates to the victorious government. Decimate seems only to have been used "properly" when it was cited by historians referring to the original Roman custom. Only a "scowling pedagogue" would insist that it be strictly reserved for that historical purpose.

A particularly attractive word category is represented by the so-called onomatopoetic words, those that imitate actual sounds in nature. Such words had early appearances: mum (1377), buzz (1530), ding-dong (about 1560), to name a few. But my particular favorite is bow-wow, which was not used to stand for the dog itself—only its bark—until around 1800 in a poem by William Cowper, the rural poet. Cowper had earlier written a slight bit of verse that he entitled "On a Spaniel, Called Beau, Killing a Young Bird." He then responded with "Beau's Reply," which coined the new usage and still gives us a smile in the bargain:

Sir, when I flew to seize the bird
In spite of your command,
A louder voice than yours I heard,
And harder to withstand . . .

Well knowing him a sacred thing,
Not destined to my tooth,
I only kiss'd his ruffled wing
And lick'd the feathers smooth.

Let my obedience then excuse
My disobedience now,
Nor some reproof yourself refuse
From your aggrieved bow-wow. . . .

In the face of this wealth of detail, the *OED*'s editors were constantly aware that their work would be closely followed by future dictionaries. And it has been. But to put off the truly sedulous apes, the editors, it is rumored, concocted a single spurious word, complete with false etymology and meanings. It may even lie somewhere in those 15,487 pages to this day, a lexicographic time bomb waiting to catch a slavish imitator (as indeed it may already have done). A scholar could spend a lifetime hunting down that word, with no more chance of success than a Boy Scout on a "snipe hunt."

Michael Olmert

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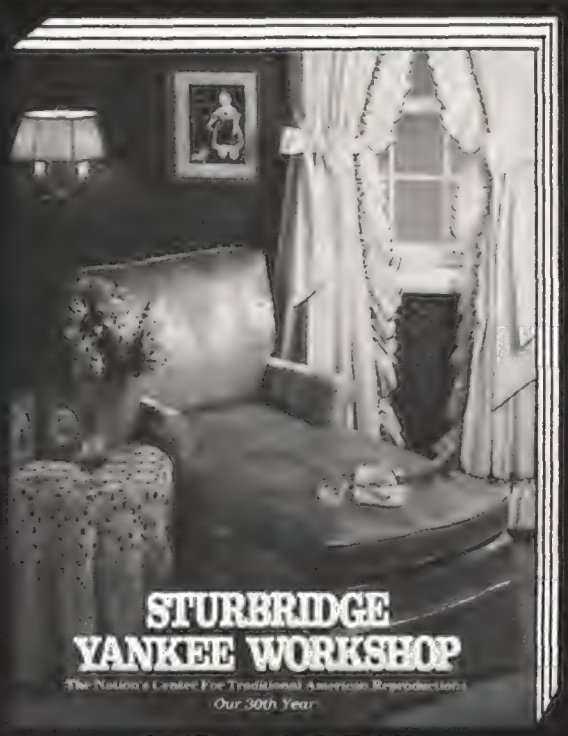

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Snow-capped summit of Kilimanjaro, seen over evening clouds, rises nearly four miles above Africa.

Article and photographs by John Reader

The beckoning snows of Kilimanjaro, Africa's 'mountain of greatness'

Ice fields, a shadowy ash pit and the legend of a leopard that froze to death half a century ago draw climbers to this solitary massif

"If a cow had died up there seven years ago, do you think there would be anything left?" asked Simon.

"Well, maybe, you see if the . . ." I began to explain, but my guide would not be interrupted.

"And when was the leopard found? 1926? Over 50 years ago. And you want to climb up and look for it?" Laughing, he walked to the foot of the crater wall and settled himself comfortably in a sunny spot sheltered from the wind. At 19,000 feet in the

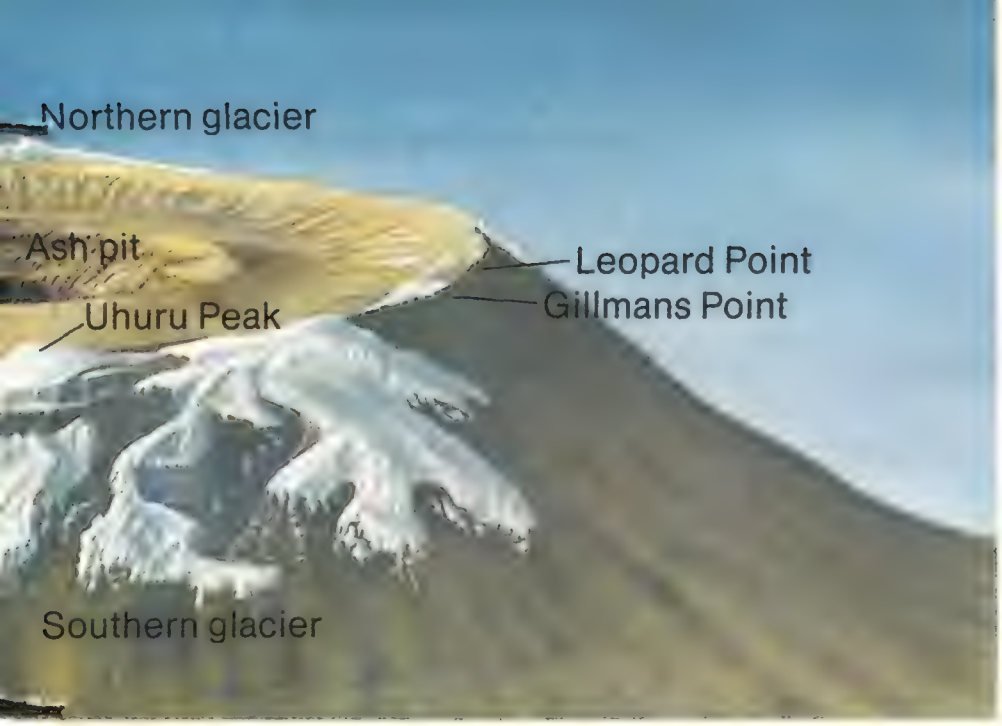
In artist's rendering of an aerial view, 1.5-mile crater dominates the summit. Uhuru is on near side.

The central cone on the Kilimanjaro massif is Kibo, which still shows some signs of volcanic activity.

crater of Kilimanjaro, the eye constantly seeks such havens and the feet have a powerful inclination to carry you to them. More than anything else you want to relax and allow a spell of blissful sleep to smother the persistent awareness of wind, cold, thin air and the absolute absurdity of trying to do anything productive at high altitudes.

Several days before, at a much lower altitude, it had occurred to me that the extent of my exhaustion at any given moment could be gauged very accurately by just how unnecessary any task seemed. Since then I had frequently rested in the total conviction that there was no need to do anything else. In the crater under Leopard Point this principle was especially applicable. The crater wall promised an arduous climb, Simon's argument was persuasive, and he had eloquently demonstrated his determination not to participate in the search for a leopard that had died more than 50 years before (opposite). I was tempted to join him beside the sunny sheltered rock. After all, even Ernest Hemingway had been content to work from hearsay. He immortalized the animal in lines from his story "The Snows of Kilimanjaro": "Close to the western summit there is the dried and frozen carcass of a leopard. No one has explained what the leopard was seeking at that altitude." But there is no record of his having climbed the mountain to confirm that there really was a leopard corpse. At the same time, though, he had created a powerful image. What was the leopard seeking at that altitude?

Kilimanjaro is a singular mountain; few rise so high in such splendid isolation. It is a solitary volcanic massif standing on a plateau just 2,500 feet above sea level. The mountain arose only a few million years ago from the geological process forming the African



Rift Valley. Three main vents dominated the massif. Erosion reduced the oldest of these, Shira, on the western side, to a moorland plateau bounded by hills which once had been the crater rim. Mawenzi, on the east, became inactive more recently; though the bulk of its cone has gone, the central core remains, a forbidding column of jagged, brittle rock. Kibo, the last active vent, rises from the saddle between Shira and Mawenzi; it is the summit of Kilimanjaro, a magnificent cone crowned with ice. Only about 1.5 square miles of ice, it is true, an insignificant fraction of the 5.8 million square miles of ice that burden the Earth in total, but a magical phenomenon nonetheless. A phenomenon which the indigenous people once sought to explain with folk tales of a solid silver dome protected from avaricious men by intense cold and mysterious disabilities. A phenomenon seemingly so inappropriate to its situation—only three degrees below the Equator—that for many years after its discovery, educated men in Europe refused to believe that it existed.

Somewhat surprised by my own determination, I left Simon dozing in the sun and trudged southward, toward Johannes Notch, where the climb to Leopard Point promised to be more gradual than via the direct route. Though I knew Simon probably was right and the leopard must have disappeared long before, I still cherished a faint hope that I would find some evidence of it—a bone, a tooth. Even if there was none, I wanted to see where the leopard had died.

The floor of the crater is composed of loose rocks. The crater wall is a daunting heap of large irregular blocks. Throughout, the rock is brittle and sharp. Chocolate brown in color, the blocks are split by shadows whose intensity is heightened by the frequent proximity of snowfields and terraces of glacial ice. The sun burns fiercely, the wind is piercing, the air is so thin that each step requires a deep gasping breath. Headaches pound the brain in time with the heart; the stomach is empty enough to inspire hunger but the mere thought of food induces nausea. Few living creatures can last long on the top of Kilimanjaro without some imported means of survival. We had a tent, sleeping bags, a stove, fuel and freeze-dried food, but incentive was the most essential commodity, and incentive always seemed the hardest to conserve.

Beneath Johannes Notch I began to climb, taking a gently angled route to the rim. The crater wall was about 100 feet high; Leopard Point lay about 500 feet north. At that season the rim was completely bare of snow, so I could investigate every likely spot. Some seemed more promising than others, and within 30 minutes I had examined all that I could reach. The rim was no more than 15 feet wide, so the area I covered was not extensive. I found three rusty cans cached among the rocks, two full of kerosene, the other empty. On a small level patch beside the rock that marks the peak of Leopard Point I found a tea-tray-size piece of galvanized metal with a hole in the middle, suggesting that it had once been nailed to something. But there was no sign of a post anywhere, nor any scrap of a leopard. No bone, no tooth, not even a word on the metal to confirm that this was where the corpse had once lain. Just a piece of metal and a view across a forbidding landscape of ice and volcanic debris with the sun about to set beneath the western rim.
A desolate, forsaken place.

I sat for a few minutes. There was no visible clue

In 1926 these missionary nurses saw the frozen leopard that would so entrance Ernest Hemingway.

as to what the leopard might have been seeking at that altitude, but it was quite obvious that whatever it was had provided enough incentive to drive the creature to the point beyond which further progress was impossible: its limit. If it had turned back, the leopard could have descended to safety without great difficulty, but it had stayed and probably froze to death.

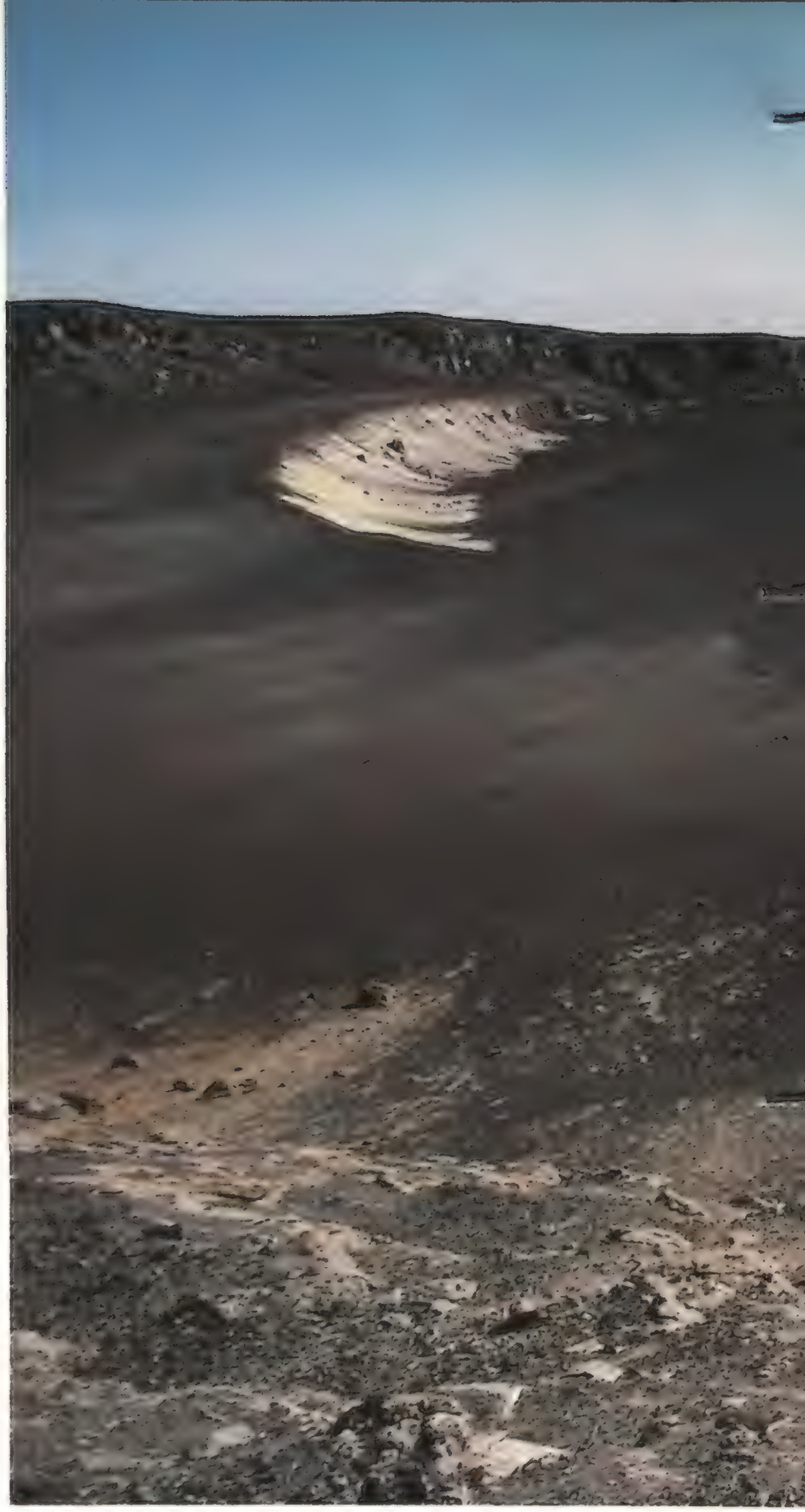
Curiously, Kilimanjaro was shrouded in obscurity and myth much longer than its magnitude deserved. Quite apart from its remarkable crown of ice, the mountain does, after all, stand nearly four miles high just 180 miles from the East African coast, where trade had been conducted by Phoenicians, Greeks, Arabs, Chinese, Portuguese, British and French. On a clear day Kilimanjaro can be seen from more than 100 miles away, but for some reason this most striking and accessible feature of the African landscape escaped explorers' attention.

To all intents and purposes, Africa's highest mountain was unknown to the outside world until a German missionary, Johannes Rebmann, first set eyes on the peak in May of 1848. He learned that, depending on local languages, the name Kilimanjaro could mean "mountain of greatness" or "mountain of caravans"—a landmark for travelers—although the derivation remains debatable. His report was published in London a year later and caused a considerable furor among geographers. A mountain high enough to sustain snow standing near the East African coast lent support to those contending that the Nile rose from the east side of the continent. Kilimanjaro was the source of the Nile, they declared. Opponents claimed the source of the Nile was a lake farther inland; eventually they were proved correct.

The existence of snow-capped Kilimanjaro was finally confirmed, 13 years after Rebmann first saw it, by an expedition led by Baron Karl Klaus von der Decken, a wealthy young German aristocrat. The expedition's geologist, Richard Thornton, recorded numerous observations of the snowy peak and estimated its height to be 20,000 feet above sea level.

Today Kilimanjaro stands in the independent re-

John Reader, British writer and photographer, lived in East Africa for ten years. Universe Books will publish his Kilimanjaro *in the autumn.*



The author decided against climbing down into the ash pit, near top, at the center of the inner crater.

public of Tanzania and is climbed many times each year. Tourists are hustled up and down the eastern slopes in a constant stream. They spend four nights on the mountain in huts provided by a Norwegian aid program. Clothing, food and equipment are supplied, guides lead the way, porters carry the gear, but it is a tough trip nonetheless. If they are to reach the top, the tourists must walk about 50 miles and exert themselves to an unprecedented degree at altitudes few of them have encountered before, with minimal opportunity for acclimatization. For each one who succeeds many more abandon the effort in the final stages, but they all leave the mountain with a sense of personal achievement, giving eloquent testimony to Kilimanjaro's singularity.

With nothing to show of the leopard, I returned to our tent. We cooked up a freeze-dried Chicken Oriental, but only Simon ate, and I vomited not long after he had finished. Simon was concerned; he squeezed my sides as I retched and wanted to know if I was ill or just sick. It took me a little while to grasp

The saddle between Kibo (slope at left) and Mawenzi is an alpine desert where very little life can survive.

his meaning: was I vomiting simply from nausea, or was I suffering from something more serious? Pulmonary edema, perhaps, a severe affliction of high altitudes which, by a sort of reverse osmosis, floods the lungs with fluid from the blood, thus impeding oxygen intake. Early symptoms are nausea and vomiting, but I blamed the smell of the reconstituted freeze-dried food. No, I told Simon, I was just sick, and crawled into my sleeping bag more concerned with the problem of getting out in a hurry should I feel nauseous again than with the threat of pulmonary edema.

By six o'clock we were both zipped up inside the tent. The temperature was already below freezing and fell to 15 degrees by dawn. Sleep, when it came, was shallow, intermittent and mixed with weird dreams. I wore my balaclava, and occasionally it twisted across my mouth as I slept and I would awaken out of breath, with a sudden fear of suffocation. Sharp movement resulted in a piercing headache, and in the dark even raising my head produced a brilliant white ring behind each eye, like a large pair of glasses.

Rocks in the crater began to split around midnight. Some cracked like pistol shots, others broke with a deep reverberation that shook the ground beneath us. The ice cracked, too, creating fearful visions that pieces from the block nearby might fall on us. Later there were cracking sounds beside my head as the water froze in my bottle and in the pot we had left on the stove.

I too had been drawn to Kilimanjaro by the mountain's singularity, and like every tourist I believed the attraction I felt was particular to myself. I had read "The Snows of Kilimanjaro" long before I first set eyes on them, and I first saw the mountain long before I climbed it. From an office block in Nairobi, from the road to the cottage I occupied on Riara Ridge, from the Ngong Hills, from the Chyulu Hills, from the Amboseli Plains, from aircraft windows, from cars: I frequently gazed at Kilimanjaro during the years I was based in Nairobi, and from that familiarity grew the ambition to climb the mountain and photograph the snows. I thought I might also look for the remains of the leopard. Hemingway had set the puzzle as a metaphor for the plight of the dying, unfulfilled writer who is the central character of his story, but to me it was also a sharp incentive for an exploration of the mountain itself.

In four separate excursions I spent a total of five weeks on Kilimanjaro. They were independent journeys, usually made in the company of two guides. Occasionally we used part of the tourist route, sometimes we even enjoyed a night in one of the huts, but for the most part we followed more lonely trails. One ascent began in the forest above Mweka. We camped

on the moorland above the forest, and from there we turned west for a walk right around Kibo at 14,000 feet. That journey covered about 60 miles and took eight days; we did not hurry. The first two nights were spent in the Karanja Valley and in the Great Barranco, under the southern glaciers. We slept in the open and the Milky Way arched from the peak above us like spray blown from a white wave top. My guide kept a fire going for most of the night, mainly to deter wild dogs and leopards, he said, but also to provide some warmth. Even so, by morning our sleeping bags were covered with frost.

From the southern glaciers we clambered over the southwestern shoulder and onto the Shira Plateau; from there we tackled the northern flanks, where the only water we found lay in a puddle much trampled by buffalo. The tedious traverse took two days. We clambered in and out of innumerable ravines and frequently looked down on the roofs of Loitokitok, where Hemingway had been an honorary game warden in the early 1950s. We crossed the saddle and explored the lower slopes of Mawenzi and, finally, we climbed Kibo itself.

The assault on the cone begins at about 15,500 feet when you first set foot on the loose scree above Kibo hut; it ends at Gillmans Point on the crater rim, and the experience of covering the distance between those two points is agonizing. At least I found it so, and I speak with the authority of having done it twice. Gillmans Point is a little more than 3,000 feet above Kibo hut; the distance covered on the way up is about 11,000 feet. The climb is not difficult in mountaineering terms. You could say it is like clambering up nine Empire State Buildings laid end to end on an incline, or like mounting a staircase more than two miles long. But at 15,500 feet, where the final ascent begins, there is little more than half the density of oxygen which occurs in Manhattan or at the foot of staircases.

George Mallory, the mountaineer who died on Everest in 1924, once said that he climbed mountains because they are there. That deceptively simple remark hints at an affinity with wild places which is easier to understand when you reach the top of a high mountain. High mountains are the wildest places on Earth, so wild in fact that little can live on them permanently. They penetrate the thin blanket of green and animate things that life has wrapped around the globe and reveal an older Earth. People are drawn to such places. The crater on Kilimanjaro, for example, is a primeval and very uncomfortable place, yet it awakens a compelling mixture of reverential wonder and fear, similar, I suspect, to the compulsion that draws some people unquestioningly to church. Perhaps such places, like churches, invite us to explore the fundamentals of existence.

Awakening from our memorable night in the crater, we found that the incentive to explore had returned with the sun. We breakfasted on granola and hot sweet tea and trudged across the ice field to the foot of the inner cone. An hour later we stood at the top of that mile-long gentle slope —and incentive had flagged again, though our view of the inner crater was inspiring enough. The slopes below were patched with reds and browns and bright yellow deposits of sulfur. Vapor rose from fumaroles in the sulfur beds. At the center of the inner crater rose another, smaller cone, and from its rim the shadow of the ash pit seemed to drop into the very heart of the volcano. We gathered our goods and the remnants of our energy and scrambled

Guides ascend a rock wall at Arrow Glacier on the way to the summit; this is not the usual tourist route.

down the slopes. The ground was warm near the fumaroles, and soft; occasionally we sank to our knees in it. There was a strong smell of sulfur, oxygen seemed desperately scarce, the stride shortened, the pace slowed and by the time we reached the rim of the ash pit I knew that like the leopard I had reached my limit.

The circular Kilimanjaro crater is relatively young. Ice has clothed the peak from time to time ever since the volcano grew above the equatorial ice line. The advance and retreat of the glaciers seems to correlate with the Ice Ages known in the northern hemisphere. From about 70,000 to 10,000 years ago, for example, when ice dipped down to latitudes of Berlin in Europe and Cincinnati in North America, Kilimanjaro's summit was completely engulfed by thick ice, with lobes reaching down to 10,000 feet on some slopes. Much of the mountain's spectacular landscape was created during this time.

The most recent glaciation on Kilimanjaro occurred between 1400 and 1700, when the northern hemisphere was in the grip of the Little Ice Age. Since then the ice cap has been retreating, and if the trend toward a milder climate continues the Kilimanjaro ice cap will disappear entirely. Yes, the snows of Kilimanjaro are melting—rapidly.

Plenty of ice remains, however, and it is still a "spectacle of imposing majesty"—as described by Hans Meyer when he made the first ascent in 1889—but the spectacle is much more approachable than before. Nowadays it is possible, if inadvisable, to climb the mountain in nothing more substantial than a pair of tennis shoes; you can reach the ice but you need never step on it. The retreating ice has laid bare the crater itself. Now it is possible to explore every corner. You can examine the sulfur beds and feel the heat of the volcano in the hot vapors from the fumaroles.

It had been my ambition to climb down into the pit. A few climbers had made the descent before me; I had details of the best route. It was not a difficult climb but I did not have the incentive to make it. I knew that although I could probably get down to the boulders at the bottom of the pit easily enough, I would never be able to get out again, and the thought gave rise to a sudden vision of freezing to death not long after sunset. With more relief than disappointment, we turned from the rim and sought shelter from the rising wind beneath a buttress. By then it was noon, so we ate a few dried

Fluted ice fields of Great Northern Glacier have eroded; the snows of Kilimanjaro are disappearing.

Outsized heather forms dense thickets close to the 9,000-foot level; several biomes band the mountain.

Leaves of giant lobelia close protectively around bud when nighttime temperatures fall below freezing.

Withered leaves of grotesque groundsels protect tall stems; the leaves also close to protect each bud.

apricots for lunch. And then we clambered up onto the northwestern rim of the crater where I was suddenly confronted by the sight of the Great Northern Glacier as it vanished and reappeared from among the clouds blowing in on the northeast wind. These were the snows of Kilimanjaro (pp. 46-47). Not just snow, but ice, vast cliffs and terraces of blue-green ice laid across the shoulders of the mountain like an imperious cloak. I cannot recall any sight that impressed me quite as much. It was so sudden, so unexpected. The ice cliffs were up to 100 feet high, fluted into pillars and buttresses as though by design rather than by natural effect. The ice was pale green where the sun shone through it—glistening, rippled, smooth and shining. My sensibilities were heightened by exhaustion and unimpeded by incentive, ambition or even reason. I simply stood and gazed, and some minutes passed before an awareness of the need to take photographs disturbed my reverie.

Clouds and patches of deep-blue sky created fascinating shapes and patterns on the ice. As I crossed a ridge, two huge ice buttresses emerged from a bank of cloud, catching the sun like billowing silver sails. Through the gathering cloud I caught a glimpse of Simon crossing the ice field near our camp, and as I turned in that direction I vomited, violently and completely without warning. "I'm doing too much," I thought, and remembered the hazards of overexertion. But if this is too much, I asked myself, reviewing the meager accomplishments of the day, how could I possibly do less?

The Kilimanjaro crater, where we had spent the day, offers death more readily than it encourages life, and such a hostile place is surely one of the archetypal ends of the Earth. But the crater also qualifies as a beginning. Its harsh environment approximates that of the primeval Earth, and while the descent from the crater undeniably is a climber's happy retreat to home comforts, the route is also marked by the beginning and proliferation of life.

Lack of water, extremes of temperature and intense solar radiation militate against the survival of living things in the crater. Rainfall averages around five inches a year, temperature may soar to 105 degrees by day and drop to 15 at night; the thin air filters little of the sun's ultraviolet radiation. Not much can live under such conditions.

Below the crater rim, however, conditions improve; rainfall increases with decreasing altitude, temperature ranges are less extreme. Kilimanjaro is girdled by five ecological zones; in my weeks there I traveled them several times, both ascending and descending the mountain, but a weary climber appreciates them most when coming down, for the environment becomes progressively more congenial.

The summit zone is marked by glaciers and the absence rather than the presence of vegetation, and the character of the next three zones is similarly revealed in their names: alpine, moorland, heather—a northern flavor, you will note, and thus a clue to another feature of Kilimanjaro's remarkable singularity. Because the mountain is so high and stands alone so close to the Equator, and because environmental conditions steadily improve down its slopes, a descent from the summit to the foot of Kilimanjaro is akin to traveling from the Arctic to the Equator: from ice field to equatorial rain forest; from temperate woodland to tropical savannah; from desert to heath, marsh, lake and plain. The Kilimanjaro ecosystem contains examples of environments found across a hemisphere. Kilimanjaro, for all its size, is a microcosm of life on Earth.

Striking adaptions occur among the vegetation in each of the zones that girdle Kilimanjaro, but the most striking of all occur where the alpine merges into the moorland zone. These are the giant groundsels and lobelias (opposite), weird plants with familiar names but quite unlike anything that exists anywhere but in such high equatorial environments.

The giant groundsels and lobelias belong, respectively, to the same genera as the weed and the delicate bedding plant familiar to gardeners everywhere. Botanists consider both groundsels and both lobelias to be as closely related as zoologists regard, say, the brown and the rainbow trout. Botanical classification of this kind is based upon the structure of the reproductive organs, the flowers, and in this respect the relationship of the Kilimanjaro giants to their common-garden counterparts is indisputable. Everything else—size, growth pattern, life-style—is directly related to the problems of living high up on Kilimanjaro.

The plants themselves are unmistakable. The groundsels may stand 12 feet high, with a distinctly too-heavy, off-balance look that adds to their general air of improbability. The stem is massive and covered with a dense, feltlike mass of dead leaves. When present, the few branches look more like ill-considered appendages than genuine limbs: each is as thick as the stem and each is crowned with a large luxuriant cabbagelike rosette of leaves from which the flower stem emerges in season.

As might be expected, insulation is the crux of the groundsel's adaptions. At night the leaves, which are up to three feet long, close around the bud. By morning the entire plant may be covered with frost, but the leaves open to the sun as soon as it rises. An early start means that transpiration begins to place heavy demands upon the water-flow system long before the ground and the roots have thawed, but this problem

is countered by water reservoirs in the stem which are insulated by the wad of dead leaves around it.

The giant lobelias, though smaller than the groundsels, face the same problems and have evolved similar adaptions. They too grow in the form of a rosette, but they have no stem standing any distance above the ground, and their leaves are smaller.

As conditions gradually improve with decreasing altitude, there comes a point (albeit a rather large and diffuse point) at which the factors which so restrict life higher up become positively beneficial. Sunshine is less extreme but still plentiful, frost is neither so frequent nor so severe, rainfall is adequate. With the improved conditions, plants begin to grow with some luxuriance, not merely survive. The tussock grasses, the denser shrubs and the giant heathers are examples of this trend. So too is the profusion of more colorful wild flowers, the banks of bracken, the skeins of lichen and the brambles.

The environment becomes more congenial, and at last you enter the forest. Forests are climax vegetation: they eventually will appear wherever there is enough rain and the right amount of sunshine. The montane forest on the lower slopes of Kilimanjaro is the climax of all the trends that the journey down the mountain has followed. It receives the highest rainfall, enjoys the most beneficial combination of sunshine and temperature extremes, contains the grandest plants and sustains the greatest biomass. It is also a welcoming place after the summit.

Descent from summit ends in the forest, where lush growth, shade and rainfall offer welcome haven.

On our last morning in the crater, we struck out for Uhuru Peak, 19,340 feet above sea level, the summit of Kilimanjaro and the highest point in Africa. We headed south across the ice field; in places, boulders and rocks were bare. The eastern crater rim stood in hard silhouette, the sun not yet high enough to light the inner wall. Light clouds wavered about the rim, varying the intensity of blue in strong but repetitive compositions of sky, rock and ice.

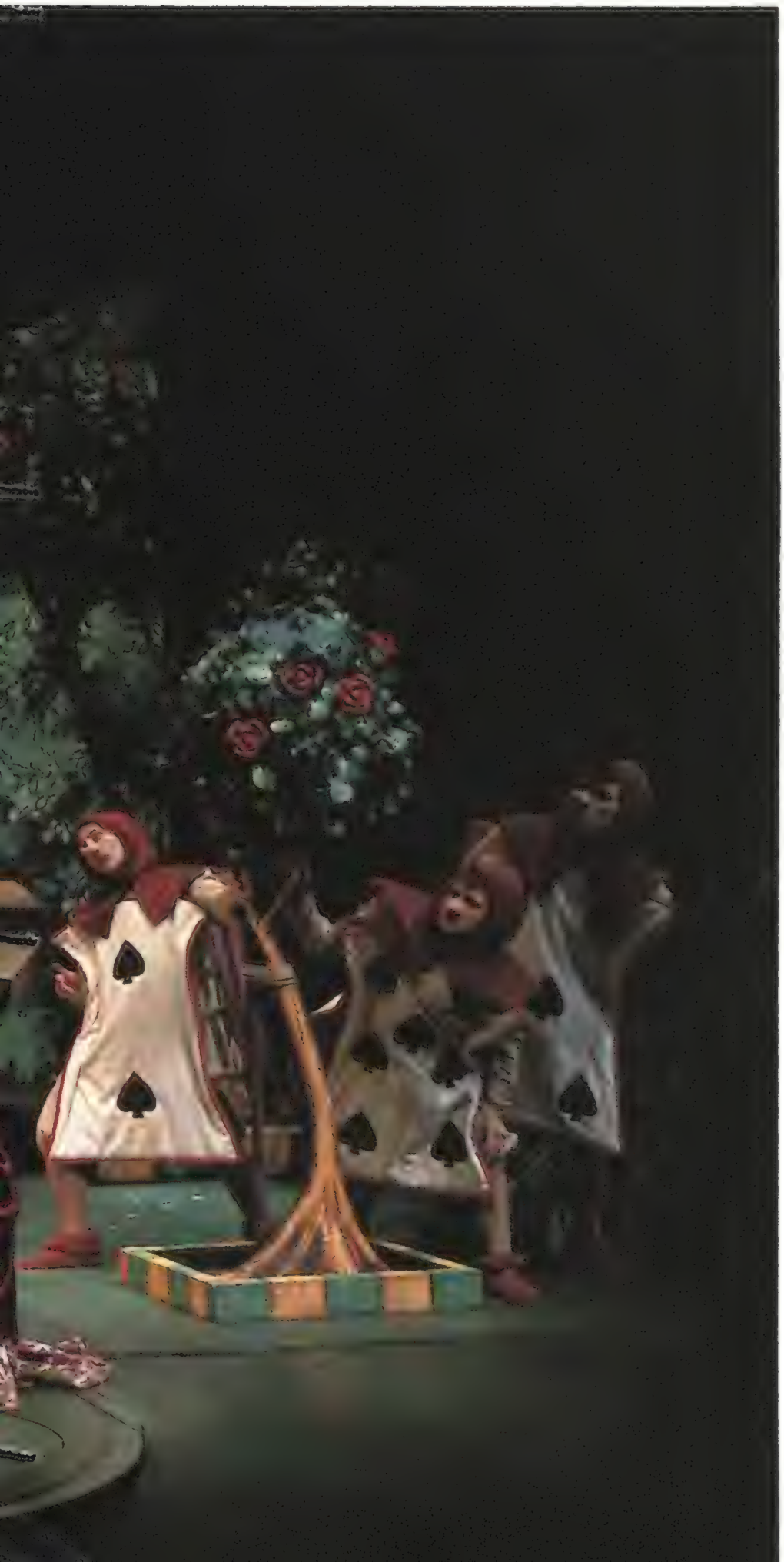
The end of the long, laborious slog around the crater rim to Uhuru Peak should be the culmination of the Kilimanjaro experience, but I must confess that I found it an anticlimax. I reached the summit, I stood with Africa and much of the world at my feet. I recall a sense of relief, but none of achievement. On reflection, the leopard I could not find, the ash pit I did not descend and the images of the ice cliffs that I could not capture completely all impressed me more deeply than those moments at the summit.

This time when we got back down to the forest again, I was struck by a wonderful sense of relief. It was like a homecoming—there was shelter, water and even food if I searched for it. They say that mankind evolved from a forest environment, so perhaps my relief had something to do with the sense of continuity and resilience that such places evoke. The vegetation around you existed in much the same form one million years ago. A haven, a comforting place, and without doubt the proper haunt of leopards.

By Randy Sue Coburn

Children's theater comes of age in a unique Minnesota playhouse

For youths who aspire to a career on stage, or just a seat on the aisle, Minneapolis provides a lot more than greasy kid stuff



As John Clark Donahue holds auditions for the Children's Theatre Company's production of *Alice in Wonderland,* what little tension there is in the darkened theater dissipates with one of his off-the-cuff comments. "I have no idea how to do any of this," he tells the adults, teen-agers and children assembled, "and I'm sure you don't, either."

He means what he says, but not very literally. It is because of Donahue's powerful artistic vision that the Children's Theatre Company and School (CTC) of Minneapolis is widely regarded as one of the finest institutions of its kind. Donahue (p. 54) is the magician who, for almost 20 years, has led the company through a rags-to-riches story worthy of its own stage.

Any magician knows that some of the best tricks occur after you show the folks there is nothing up your sleeve. That Donahue has plenty hidden elsewhere is perfectly apparent when he bounds onstage to demonstrate an ungainly walk for Tweedledee and Tweedledum, a Cockney accent for the Queen of Hearts' workers or a frantic piece of business for the White Rabbit. He passes around illustrations by both Tenniel and Rackham for inspiration. Having worked with most of the adults in the theater's professional company for years, Donahue instinctively zeroes in on the members ideally suited to read for the March Hare and the Mad Hatter. Laying down scripts, rolling up pants legs, assuming smug—quite crazed—expressions, they deliver so completely that there is no doubt as to whom these parts will go.

Meanwhile, hanging from the fly pipes above the stage are elaborate sets for *Phantom of the Opera,* an ominous adaptation of Gaston Leroux's novel that, on a recent night, drew quite a few adults, some of whom were unaccompanied by children. Annie Enneking, the 14-year-old girl who plays Alice (opposite), attends the small, informally structured conservatory school which the CTC opened last fall to complement its afternoon theater school, a program for which local junior high and high school students have auditioned during the past 13 years.

The building in which all this activity occurs is no rude structure, either. Renowned Japanese architect Kenzo Tange designed a highly sophisticated $4.5-million complex specifically for the CTC. The same young person one sees in the afternoon, taking dance class in a spacious studio lit by an entire wall of windows, may be observed that night cheerfully handling expensive equipment in the theater's sound booth.

All too many of us have learned through dreary ex-

Onstage, Alice (center) encounters Duchess at croquet game, where flamingos are mallets, hedgehogs balls.

Photographs by George Heinrich

John Clark Donahue, founding father of the CTC, leads theater students in an improvisation class.

Resident artist Steven Rydberg peers over his painting; it was used for this season's CTC poster.

perience to think of children's theater as little more than a tired parade of papier-mâché mushrooms and troops of people running through the aisles screaming, "Join me!" In the Twin Cities they know better. Although there is a long tradition of quality theater for children in Russia, Poland and other Eastern European countries, most American communities invest neither the requisite money nor manpower to mount ambitious, original productions for younger citizens. The CTC does. "It's sad," Donahue says, "when we think our children don't deserve the best."

A colleague of Donahue's has compared his approach to the views of Swiss child-psychologist Jean Piaget, who suggests that a child's intelligence develops in response to active involvement and direct challenges presented to the mind and imagination. Still, Donahue has his critics. In his office, where through a series of windows he can observe whatever is happening in the theater, a visitor picks up one of his many children's books and finds, tucked within its pages, a letter from the early 1970s in which an adult complains that CTC plays are frequently beyond the grasp of her children. She may have been referring to the *Sleeping Beauty*, inspired by the Kabuki form, or even Donahue's *The Cookie Jar*, a 1972 play tinged with Sixties-style sentiments of love and peace. At any rate, the CTC continues to receive similar letters on occasion, and Donahue's response remains the same: "People tell me, 'The children won't understand it,' and I say, if that's the case, how can you take a child to the ocean?"

Because of such beliefs, the CTC is a comfortable place for almost any artist who reveres the child spirit. Dr. Seuss was delighted with the popular 1980 production of his *The 500 Hats of Bartholomew Cubbins*, the first authorized stage adaptation of one of his works, featuring John Peitzman in the title role. The play will be restaged next season. Unfortunately, at 14, John can no longer sing the songs required by the part because his voice is changing, but, as yet, nobody else has mastered the trick of handling all those hats. Recently Donahue met with famed children's author and illustrator Maurice Sendak (SMITHSONIAN, January 1982), who is interested in a collaboration. These days Donahue has also been in touch with Edward Albee and Tennessee Williams, neither of whom is popularly associated with what is considered to be children's entertainment.

Only once has the CTC produced an existing script. Years ago, a scheduled production fell through at the eleventh hour and *Oliver!* was hurriedly staged.

Randy Sue Coburn is a free-lance writer based in Washington, D.C. Her article about visual arts awards (AVA) appeared in the May SMITHSONIAN.

Every other CTC play is an original, or an original adaptation of an existing story or book. Music and lyrics, like the plays they are written for, are produced by resident artists or commissioned from outsiders.

There is talk of touring internationally with the exceptionally well-received 1980 production of *The Story of Babar, the Little Elephant*, in which impeccably turned-out elephants drive cars, dance and test the expressive range of their trunks. One reason the company has not toured nationally with a fully mounted production is that few potential hosts are prepared to pay a professional children's company the equivalent of grown-ups' fees. "It's as if they think that our adult actors must eat less because they perform for children," grumbles one CTC staff member.

A theater where hardly anyone is bored

Any actor in the company will tell you that the worst audiences are those in which there are only small children. Optimal audiences are comprised of a healthy mix of age groups, from the very young to the very old, because a greater sense of community permeates the theater. "I believe that the things of childhood stay with us," Donahue has written. "Somehow it seems to me that if we think children's theater is a good thing for our children—and indeed for us—it's because we think it will have something to do with those sensations and perceptions and feelings and involvements of our collective childhoods." When the CTC is at its best, hardly anyone is bored—unless they would rather be in front of a television set anyway.

It is perhaps best to begin at the beginning. In 1961, three energetic adults, who called themselves the Moppet Players, borrowed $100 to stage an eight-play season of theater for children in the rent-free back room of an Italian restaurant. Their timing could not have been better. Sir Tyrone Guthrie was coming to town to defy dire predictions and launch what would become a foremost regional repertory theater; its success signified the advent of a full-blown arts boom. Theater groups propagated, thanks to enthusiastic audiences and a large, generous corporate community. For the Moppets, progress was steady if not stunning. The group moved to an abandoned police station, where Donahue joined them in 1962 as painter, set designer, teacher, director and sometime choreographer.

He became artistic director in 1964 and soon there were differences over where the company's accent should be. Donahue struck off to begin a new company in a new home, the Minneapolis Institute of Arts, which offered him a lecture hall for a theater.

By 1973 the CTC had become a division of the Minneapolis Society of Fine Arts, the umbrella organization that supports and governs the Institute

Resident scenic artist Cate Whittemore works on an intricate backdrop for *Alice in Wonderland.*

In a mime class, actress and teacher Wendy Lehr (left) guides a student performer, Michalla Petersen.

Young theatergoers speak up at a question-and-answer session that follows performance of *Alice*.

They're off to see the Wizard in a production of *The Marvelous Land of Oz*, CTC show taped for cable.

and the Minneapolis College of Art and Design. A year later, amid great national attention, the impressive new CTC facility opened next door to equally fine Kenzo Tange additions to the Institute and the College. Most of the theater's building fund was raised locally, with the important exception of a $500,000 award from the Rockefeller Foundation. The company came to a complex with not only extensive dressing rooms, but rehearsal rooms, a costume shop, a studio theater, a prop shop, a recording studio, a wardrobe-storage area—even a wig room.

It certainly seemed as if Donahue had an angel riding on his shoulder, but just as the CTC tamed its new home, the magical spell turned ugly. The time had come for an old-fashioned, Act II test of virtue. In 1975, the Minneapolis Society of Fine Arts faced unanticipated costs. After his first season, Donahue was told by the Society to cut his operations budget by 50 percent, yet generate the same income that he had produced with a full budget and staff. (By then, audiences exceeded 117,000 per season.) Since 80 percent of the CTC budget went for staff salaries, cutbacks would mean dismissing many of those who had stuck with Donahue through lean years.

'We Need a Miracle'—and they got one

"Our only alternative," Donahue says today, "was to go independent and raise the necessary money ourselves. We thought that if we could maintain our integrity, we would ultimately survive." A board of directors was organized to help raise $425,000. The Dayton's department stores lent to the CTC an executive with theatrical experience, Sarah Lawless, to organize a campaign that included children going door-to-door, a senior-citizen walkathon and a direct-mail donation drive. The entire effort was called "We Need a Miracle." The CTC got one.

The ultimate irony, though, is that these days the CTC leases the theater that was built for it. The organization itself has grown to a $2.44-million-a-year operation with 60 full-time employees. In the 1980-81 season, the CTC earned $1,400,000, mostly from tickets and tuition. In 280 performances, it reached 92 percent of capacity. The figure is not quite as good this year, which has been hard on theaters everywhere.

The CTC certainly cannot be accused of sloth. Aside from its conservatory and afternoon theater-school programs, now attended by 90 students, there are community-outreach programs and a full range of dance classes open to the public. In addition, there is an annual summer workshop.

Rana Haugen caught her first glimpse of the CTC in action when she was four. She is now a 14-year-old veteran of more than 25 productions, including *The*

Costume designer Gene Davis Buck (left) examines Humpty-Dumpty with actor George Muschamp.

Julee Cruise, who plays Queen of Hearts in *Alice*, relaxes with stagestruck pooch before a performance.

A veteran actress at 14, Rana Haugen (right), lead in *The Little Match Girl*, rests head on Wendy Lehr.

Little Match Girl (above), last year's Christmas show in which she played the leading role. Juggling her school, rehearsal and performance schedules was always a problem for Rana, even when her mother restricted her to just one production per year. It helped when she became old enough to attend the afternoon theater school, where she has been taught voice, dance, acting and improvisation by members of the acting company and others, including Donahue. But for her, the conservatory school is a custom-made solution.

The CTC does not guarantee its students and child actors work in the profession, but quite a few alumni have become prominently active in their chosen fields. Maureen Teefy played in the movies *Fame* and *Grease 2*; Jodi Thelen was one of the title characters in *Four Friends* and will appear in *The Black Stallion Returns*. A gifted dancer, Garry Lewis has performed in several Broadway plays. Linda Kelsey played Billie Newman on television's *Lou Grant*. One young CTC student is a son of Garp in the movie version of *The World According to Garp*. Rana, who is slated to appear in a Guthrie Theater production this summer, also auditioned for the ABC television series *For Better or Worse*, but did not like the contractual terms. She does, however, think she might want to be an adult member of the CTC company.

CTC turns an art student into a composer

David Samuelson, the 23-year-old director of the theater school, came at the age of 15 and never really left. He and Donahue each teach improvisation, a class specifically designed to build trust and ensemble spirit. Donahue designated Samuelson school director when he was just 20.

When Steven Rydberg (p. 54) wandered into the CTC, he was a young art student with little musical-composition education. Now, at 30, he is CTC's resident artist and musical composer. His CTC posters are sold in museum gift shops; other theaters, including the Guthrie, have commissioned him to compose scores. Similarly, 29-year-old resident playwright and literary editor Tom Olson first came to the CTC as a summer-workshop student. Company choreographer Myron Johnson was 12 when he received his first dance lessons from Donahue.

"It's very gratifying," Donahue says of the people who have remained. "They have their own creative trajectories and also an awareness of the battles fought together. When those things vibrate through an organization, you build an incredibly strong basis upon which other people can come and go. Also, we understand how to work with each other. Sure, it can get testy, working with each other for so long. We can be passionate. But I think that's a sign of vitality."

Donahue's temperamental side is as well documented as his spiritual one. Steven Rydberg recalls the time he refused to play piano during a rehearsal because he wanted to see how the show was moving onstage. Donahue tossed the 100 or so loose pages of his score into the air. The next morning, there was a basket of food on Rydberg's doorstep as a peace offering. "Now," he says, "John and I have worked together so long we've even given up arguing."

Few have been with Donahue longer than Wendy Lehr (above, left), who sometimes figures that she has stayed 16 years simply because she has paid her dues so heavily—keeping books, building props, finishing costumes and, all the while, playing leading roles. Because her teaching and acting schedules are so demand-

ing, she is constantly running between the theater and Donahue's nearby Victorian house, where she lives on the top floor. She recently played a range of characters that included the elegant Mademoiselle Sorelli in *Phantom of the Opera* and the decidedly inelegant Diana Dumbstrut, a materialistic majorette, in *The Cookie Jar*. In *Alice*, she is the White Rabbit.

Full of fun, Wendy Lehr remains excited by her work. As a tonic for the large, episodic shows that the CTC produces on its main stage, she and other company actors produce more psychologically complicated adult plays in the studio theater when time permits. She counts teaching as a rewarding part of her growth as an actor: "When you work onstage with these kids, that's the real test. They want to know if what you're saying in the rarefied atmosphere of a classroom is really honest, whether it means anything. So you have to take your knowledge and pin it down. There are kids we've absolutely agonized over, wondering whether to tell them to quit or not, and then they'll have a moment where they suddenly catch fire."

Indeed, Donahue's Zen-master aspect is never so apparent as when he is actively creating that atmosphere in his improvisation classes. Usually these classes are held in the studio theater, but at the invitation of a national conference on the education of gifted children, Donahue obligingly transports 18 students and an accompanist to show how the CTC does it. Before beginning, he confides, "I'm a practitioner of what they theorize about."

All the students are dressed in regulation CTC work garb: black karate pants and gray sweatshirts that are meant to encourage both hard work and humility. After a thorough warm-up, Donahue gently instructs them: "Don't worry about doing anything, and thus you'll be able to do many things." Soon, they are hugging one another, creating harmonies around one simply sung word, and reacting to a barrage of images fired out by Donahue in rapid succession: "Dancing hot pins, jelly beans at the races, fish in a wagon, you're downtown, you're candles and it's just about up for you—any hope for a breeze and you're out. Thank you."

Enchanted with Donahue's young people, some of the education specialists cannot contain an urge to hug them. When questions are asked for, someone calls out to the children: "What can *you* teach *us*?" If Donahue believed in grades, Rana would probably get an A for her answer. "What," she asks right back, "do you want to learn?"

Between performances of *Alice*, a bone-weary Annie Enneking (see cover) takes a nap backstage.

By Noel D. Vietmeyer

Our 90-year war with the boll weevil isn't over

After early decades of defeat for cotton farmers, then a brief victory with chemical counterattack, a new battle is looming

A century ago the boll weevil was an obscure insect living a tenuous existence on scattered wild plants in Mexico. It was barely known to science when, in the 1880s, it began gobbling up cotton fields so quickly that the growing of cotton soon had to be abandoned in central Mexico. American entomologists had to write to France to find the boll weevil's scientific name, *Anthonomus grandis*. Only three specimens were available in all the world's insect collections.

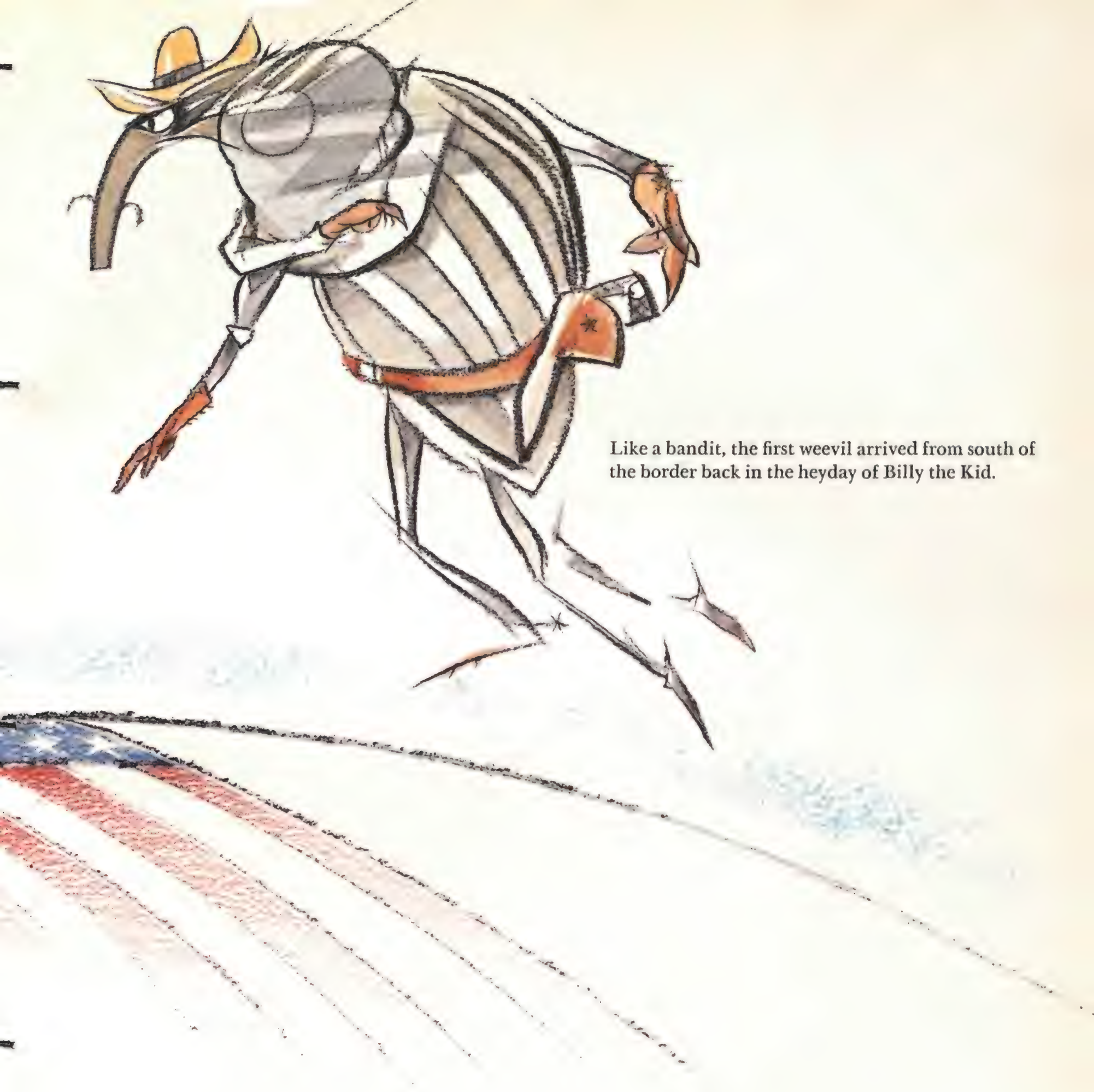
It quickly became better known. In 1892 it jumped the border and suddenly appeared in southern Texas. A letter to the U.S. Department of Agriculture from C. H. DeRyee, a Corpus Christi businessman, explained: "The 'Top' [late-blooming] crop of cotton of this section has been very much damaged and in some cases almost entirely destroyed by a peculiar weevil or bug. Our farmers . . . are at a loss to know what to do to overcome this pest . . . the ordinary methods of poisoning cotton worm have no effect. . . ."

In Washington the letter was received by Leland O. Howard, a short, balding scientist-bureaucrat who was later to become a giant of American entomology, ruling for more than 40 years over most of the country's insect-control research with benevolence and keen intellect. Impressed by the letter, Howard immediately dispatched Charles H. Tyler Townsend to southern Texas.

Townsend was Howard's opposite in appearance and temperament. Tall and thin, he was a man of undiplomatic and irascible nature. Yet he tackled the task with intense enthusiasm, describing his observations and recommendations in long, rambling letters that he dutifully wrote to Howard for nearly two years. Over and over he reported the fearful sight that was to become common across the South. Cotton fields that should have been lively with white and pink blossoms were merely green. All their flower buds were on the ground. And without buds, there could be no flowers, no bolls, no seeds and no product, because cotton fiber is actually a hair that is attached to the seed. Townsend found in 1894 that the boll weevil had destroyed 90 percent of the cotton crop in the Brownsville, Texas, area.

Boll weevils are inoffensive-looking critters: grayish-brown, humpbacked blobs of living hunger, related to the weevils that infest stored grain. Two or three of them could stand comfortably on your little fingernail, but when these resourceful saboteurs are disturbed or threatened, they characteristically pull in their legs, drop to the ground and play dead.

Townsend brilliantly worked out the main details of the insect's life cycle. Much of the weevil's length is a down-curving snout that has large chocolate-brown eyes at its base, two antennae that are used as feelers, and jaws at its tip. It uses the jaws to drill into cotton "squares" (flower buds) and bolls (seedpods) and it pushes its snout into the hole as the jaws chew through the succulent vegetable matter inside. The



Like a bandit, the first weevil arrived from south of the border back in the heyday of Billy the Kid.

snout then ingests the resulting juices. This, of course, reduces the cotton yield, but the worst damage is done when a mated female weevil slips an egg through the hole she has punctured. Inside, the egg hatches into a pearly-white grub. The grubs eat the hearts out of the squares or bolls, which soon drop off the plant.

It is thought that a female may even select a fresh square for each of her 300 or so eggs—that she feels all sides of them and, if she finds a puncture, flies on until an unpunctured one turns up. That can mean that no plant in an infested area escapes. The cotton crop can be totally destroyed.

The two entomologists, Townsend in Texas and Howard in Washington, seemed to be facing the crisis alone. The havoc to come was clear to them, but the problem was to convince others. Townsend, in his letters, argued forcefully for abandoning cotton growing throughout a 50-mile-wide strip along the Mexi-

Drawings by Robert Osborn

Hatched from an egg left inside cotton boll, weevil grub voraciously eats the heart out of its home.

can border. This, he thought, would prevent the weevil from breaking out across Texas. Howard persuaded Governor Charles A. Culberson of the wisdom of this idea. A bill was drafted and presented to the state legislature. "If these measures are not carried out," Townsend wrote, "the time is near when Texas will cease to hold its own as the greatest cotton-producing region of the globe."

Incredibly, the Texas legislators voted the bill down. Howard later attributed much of the responsibility for the enormous loss that followed to their shortsightedness. But this was only the first of many frustrations for the nation's entomologists. For decades to come, the measures they recommended for dealing with the weevil would be ignored.

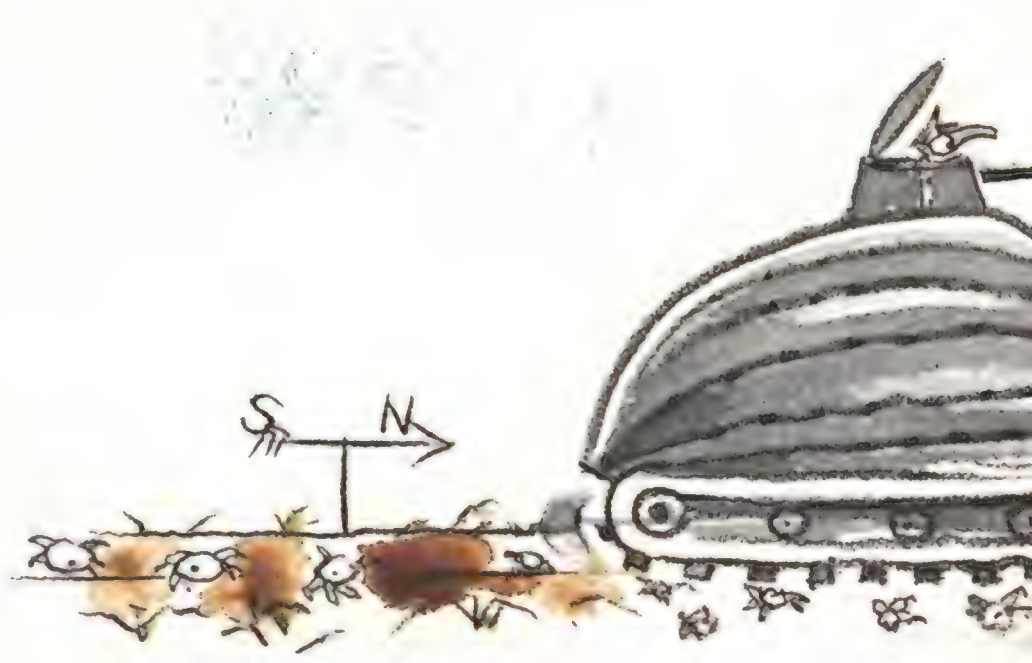
The boll weevil soon began breaking out as feared. For most of the year weevils fly only from plant to plant or for short distances to find a mate, but for several weeks at the end of the summer they are seized with the instinct to find new food and habitats to tide them through the oncoming winter. They fold forward their crusty wing covers, unfold tiny diaphanous flight wings, and soon hosts of weevils are whisked away on the wind like pollen. With a series of flights they may cover 65 miles or more in their migration. In this way, in the late 1890s, a cloud of devastation began moving out of southern Texas like a great storm. Before the weevils was an almost continuous belt of cotton all the way to Virginia—a crescent 1,100 miles long and more than 300 miles wide.

By 1900 the weevil had covered half of Texas. In 1904 it entered Louisiana. In just 12 years, one-third of America's total cotton acreage had been infested. By 1906 Arkansas had the boll weevil. People in the Southeast hoped and prayed that the Mississippi would prove a defensive bulwark against the hitherto triumphant weevil legions. The grim news came in the fall of 1907: the weevil had crossed the river above and below Natchez.

Now the way was open to the Atlantic, and the pace began to quicken. A mere 31 years after crossing the Rio Grande, the weevil had established itself nearly to the northernmost limits of cotton. Some 96 percent of the American crop was infested. And everywhere the weevil went, cotton yields plummeted at least 30 percent. In many areas the whole crop was lost. "King Cotton" had been conquered; it would never be the same again.

During the first two decades of the century, ingenious Americans produced a wealth of boll-weevil-control devices. Most were worthless; some were partially successful but too expensive for use on a cheap crop like cotton. Flimflam men crisscrossed the country offering quack remedies.

Everything was tried. When someone found weevils in the stomachs of quail, some Texas counties banned all bird hunting. In hopes of reducing the scourge, many farmers, bankers and merchants offered to buy live weevils by the jar. In 1901, the Victoria, Texas,



Moving as relentlessly as a quarter-inch tank across a cotton field, weevil leaves a swath of destruction.

Advocate reported enthusiastically: "The picking process is sweeping the state and squads of children dot the cotton fields from sun to sun." It was a gallant gesture, but useless as a control. There were just too many weevils.

Under favorable conditions the weevil can get through all four life stages—egg, larva, pupa and adult—in fewer than 20 days. One cotton-growing season can produce as many as six generations. In theory, a single pair of weevils that mate in spring can give rise to 13 million progeny before fall.

Controlling the boll weevil was the most difficult and frustrating problem American entomologists had ever faced. There seemed to be no effective natural enemies and no adequate insecticides. They could find nothing to stop the weevil's spread. Cold or dry weather slowed it down more than anything science could devise.

In 1901 Leland Howard appointed Walter D. Hunter to continue Tyler Townsend's work in Texas. From Texas, and later from Louisiana, Hunter would direct the Department of Agriculture's antiboll-weevil program for 25 frustrating years. He was not a demonstrative man and few know of him today, but he and his entomology team worked unflaggingly to battle the pest. Never before had any insect species been studied so intensively. Every phase of its life and ecology was investigated minutely. Different insecticides and machines for controlling the weevil were tested. None worked adequately.

It was often suggested that only God could remove the weevil. Prayer meetings were held. South Carolina's governor proclaimed a day of prayer for deliverance. The problem was approaching a national tragedy. The United States had long dominated the world's cotton commerce, but the little insect soon became the biggest consumer of its raw cotton. Farms, homes, even whole towns were abandoned. Workers and tenants, demoralized, moved east or north—often to be caught again by the insect. Finally, many people fled to the cities.

In infested Texas counties, children swarmed over fields hand-picking weevils like pennies from heaven.

The weevil figured in novels, cartoons, poems, folk tales and songs. All over the Cotton Belt blacks were singing the popular folk song that originated in Texas in the late 1890s:

Fust time I saw de Boll Weevil
He was sittin' on de square
Nex' time I saw dat Weevil
He was sittin' everywhar
Jes a looking for a home
Looking for a home!

The name "boll weevil" became an everyday word: cheap cigars were called boll weevils; signboards said "Forget the boll weevil and come to [our] show." In the heat of political argument one prominent official was called "the greatest boll weevil the state of Mississippi ever produced." Even today, the name is used by a coalition of fiscally conservative Southern and Southwestern members of Congress, who take pride in their pestiferous political tactics and persistence.

With all its hardships, the insect also brought a major shift in American agriculture. It forced cotton

The author, a frequent contributor who is with the National Academy of Sciences, wrote in March 1981 about the cassowary, a rare bird of New Guinea.

With development of pesticides, the crop-duster pilots took to the air to battle the weevil, *mano a mano.*

Brought to their knees by the weevil, ruined cotton farmers could only resort to prayer for salvation.

growing for the first time into Arizona and California and made Southern farmers diversify into other crops and livestock—something the government had been urging for years. After 1913, ten Southern states drastically increased their production of corn, oats, rice, white and sweet potatoes, hay, dairy cows and hogs. The people of Enterprise, Alabama, enriched by the demand for the foodstuffs produced by their diversified farming during World War I, erected a monument with the inscription: "In profound appreciation of the Boll Weevil and what it has done as the Herald of prosperity."

For 30 years Hunter and other government researchers encouraged such diversified farming as well as new cotton-farming methods that reduced the weevil's depredations. They were in conflict constantly with inventors whose poisons or devices seemed to offer instant salvation.

Then, after the war, the Department of Agriculture itself developed an insecticide for weevils. Hunter's associate, Bert R. Coad, showed that boll weevils could be controlled by thoroughly dusting the cotton plant with powdered calcium arsenate, an extremely toxic arsenic compound. Coad's work ushered in an era of successful weevil control using chemicals. The farming methods that Hunter had championed throughout his life were abandoned. But luckily—as it turned out—they were not forgotten.

Apart from the hazards of handling arsenic, the main problem of calcium arsenate was getting the plants evenly dusted. In 1922, as an experiment, Coad prevailed upon Congress to provide funds for the use of some Army airplanes to treat 3,000 acres of cotton at Tallulah, Louisiana, in the Mississippi Delta. It was found that the particles of powdered poison swirling in the air currents behind the planes spread out and clung to the cotton plants over a wide area. It was the first time aircraft had been used to dust a major farm crop and it led to today's agricultural-aviation industry. (It also led to Delta Airlines, which

grew out of Huff-Daland Dusters, an 18-plane operation based on the work of Coad and his colleagues.)

From the 1920s until the 1940s calcium arsenate was the main control for boll weevils. Then, during World War II, DDT and similar chlorinated hydrocarbons that interfere with an insect's nervous system were developed. They worked like magic. Suddenly cotton yields almost doubled. The old, longer-staple varieties were planted once more. Man, it seemed, had finally conquered his foe.

But in the 1950s the new system's limits became apparent. The blanket use of broad-spectrum insecticides exacerbated other problems. The lush cotton plant attracts many insects and it was being sprayed with more insecticide than any other U.S. crop—during the 1960s and through the mid-70s, the figure would rise to about 60 to 70 million pounds a year. Predictably, this saturation also killed off some beneficial insects. New pests were unleashed when their natural enemies, such as ants, spiders and assassin bugs, were killed off by the constant chemical rain.

And some formerly less-important insects, like the bollworm (which is the larva of a little tannish-colored moth and is unrelated to the boll weevil) and the tobacco budworm, displaced the boll weevil in some areas, including the lower Rio Grande and the Mississippi Delta. Everywhere, these species collectively inflicted losses almost as severe as, or in excess of, those caused by the boll weevil.

The farmers' response was to mix chemicals and to spray more and more, and often in higher and higher doses. That was incredibly expensive. Many farmers barely skirted bankruptcy. Many quit.

Cotton growing spread westward and a new "Cotton Belt" began to form in Arizona and California, where the boll weevil was as yet unknown. But, in the 1970s, the weevil showed up in Arizona, probably by jumping the border from Sonora, Mexico.

Repeated spraying changed the weevil genetically. In the late 1950s scientists found specimens that were unaffected by the chlorinated insecticides. Chance genes had allowed them to survive. They passed their lucky genes on to their offspring and soon virtually all varieties of boll weevils were resistant to this kind of chemical drenching.

Archenemies, the entomologist and the weevil are experts at circumventing each other's best strategies.

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With adoption of an eradication program in North Carolina, weevils have been starved out, sent packing.

Probably no other insect in the nation has been the subject of such intensive research, but the wily weevil is still one of our most destructive pests. Almost one-fourth of all the expenditures for insecticides used on American crops are applied against the weevil. An amazing array of innovations—botanical, agricultural, biological and biochemical—now have been devised to combat it. Yet the boll weevil still destroys more than one million bales of cotton each year and is responsible for a major share of some $300 million that cotton farmers spend annually for insecticides.

In the 1980s controlling the boll weevil is as important as ever. Some scientists predict that with a growing knowledge of the intimate biology and ecology of the boll weevil, we should be able to eradicate it from the United States.

Their views have sparked great controversy. On one side are the National Cotton Council and the Department of Agriculture which have actually devised a proposal to squeeze the boll weevil between two main eradication "fronts," one moving eastward from western Texas and the other advancing south and west from North Carolina. Proponents of this proposal point out that the weevil is not native to the United States, and that its main host plant here is a cultivated crop, not an uncontrollable weed. Some researchers even speculate that the country might actually eradicate the weevil by not growing cotton for one year.

On the other side are many biologists who see eradication as another nostrum, like the flimflam devices of the past. To eradicate the weevil, they believe, is an impossible dream. It would be an expensive and never-ending drain on public, state and private funds. We would be better off, these scientists claim, to learn to live with the boll weevil; rather than try to wipe it out completely, we should rely on modern farming practices and technology—along with our increased knowledge of the insect's life cycle and biology—to keep its populations in check. To prove its own case, the Department of Agriculture mounted a Boll Weevil Eradication Trial Program in 1978. The official trial period ended in 1980, but the campaign is being carried on by some 50 researchers and technicians across the Cotton Belt and backed up by administrators in Washington.

Last summer, in a hot, rickety trailer parked in a farmer's field a few miles north of Edenton, North Carolina, I met Robert G. Jones, one of the researchers conducting the trial. "The boll weevil put most people out of cotton in Chowan County," he told me, "but we haven't seen one weevil around here since June 28, 1978, and now we've got a lot more cotton than we've had for years."

A red-bearded native of New Mexico, with freckled skin bronzed by long days in the sun and dust, Bob Jones has the pioneer spirit. "People said the boll weevil couldn't be eradicated," he recalled. "That just made us try harder. Those people had made up their minds before it was even attempted!"

Back in 1978 Chowan County farmers on an average grew 384 acres of cotton, each of them soaked almost weekly with insecticide. Four years later they grew almost ten times that amount and used no chemicals at all. The boll weevil was gone. The eradication project had worked. And by backing it up with a virus that attacks bollworms and budworms, the researchers were able to dispense with all chemical pesticides in some areas. Professor Gerald A. Carlson of North Carolina State University in Raleigh has estimated that boll-weevil eradication, together with the improved control of bollworms and budworms, reduced insect-control costs by 45 to 50 percent, and that this in turn has led to a doubling of cotton acreage.

For the cotton crop, life after death

I asked local cotton farmer H. Fahey Byrum about it. "I've been growin' cotton all my life," he said; "started when I was 15, and I'm 61 now. Growin' cotton with the weevil got so expensive farmers went out of business. We had to fight him all season. We had to spray all the time. The cost was so high and those chemicals are terrible on human bodies. Cotton would be gone from this county but this program has put us to raisin' it again."

An important tool used in eradicating or managing the weevil is "diapause control." With the coming of cool weather in the fall, adult boll weevils begin feed-

ing voraciously on the cotton plant; they are building themselves a supply of fat to provide enough energy in the spring for them to survive until the cotton begins forming the squares they use as food. Then they seek protection. Some crawl into cracks in the ground, or under grass, weeds or trash. Others fly into nearby hedges, woods, Spanish moss, haystacks or farm buildings. There they pass the winter in a state of suspended animation known as diapause.

The adults are especially vulnerable during the few weeks when they are concentrated in the fields stuffing themselves before leaving for winter quarters. If the farmer destroys all cotton plants at that time, then many weevils are semistarved when they hibernate and fail to survive until food is again available in the cotton fields. Spraying insecticide on the fields also reduces the weevil population just before hibernation.

The need for treatments and the measure of their effectiveness are judged by using traps containing grandlure, a pheromone (SMITHSONIAN, March 1979) that boll weevils use to attract mates. The fluorescent yellowish cups containing it are now a common roadside sight in cotton areas.

To visit the cotton fields in Chowan and neighboring counties, to talk to cotton farmers such as Fahey Byrum, convinces you that boll-weevil eradication is not a meaningless dream. But many biologists remain unconvinced of the technical feasibility of eradication on a nationwide scale. Last year, for example, a National Research Council study concluded that there is inadequate evidence to support a national-eradication program. It cautioned that the North Carolina trial did not address some difficulties that might be met elsewhere in the Cotton Belt, that two successive cold winters had already devastated weevil populations there, that the cost of nationwide eradication could outweigh its benefits—especially as it would need a never-ending program to keep the weevil from breaking out of Mexico again.

But the Department of Agriculture is optimistic. It has made boll-weevil eradication work in North Carolina and is anxious now to try eradicating the insect right across the Cotton Belt. Eradication is a tantalizing prospect. The boll weevil can enter the eastern Cotton Belt only by crossing the Rio Grande into Texas. Can we turn it back and bottle it up in its native land? That would take us back almost a century, drastically reduce the amount of insecticides used in U.S. agriculture, and make the boll weevil once again an obscure insect living south of the border.

Beating weevil back to Mexico would be a boon to U.S. farmers, but an expulsion from Eden for weevil.

Shell Answer Series #31

LONGER CAR LIFE

How to make it last. And why.

by Jim Jaskoske, Shell Auto Care Dealer

Come to Shell for answers

S1

Your car is probably good for 100,000 miles, *if* you follow some very simple, but very important maintenance advice.

"I've had it. That's the last straw! I'm selling this car *tomorrow*." Have you ever said something like that? Do you remember what the last straw was?

A last straw can be the threat of a costly repair, the overall run-down appearance of the car, or the last of a lot of little problems piled up. For most people, I think it's usually a combination.

For 12 years as a Shell Dealer, I've been helping people take care of their cars, and I've learned a lot about last straws and how to steer clear of them. In this guide I'll pass on some of what I've learned.

The "Conference of Car Keepers": I met with an automotive engineer, a taxi fleet manager, the head of a limousine service, a classic car buff, a racing mechanic, and one of my own customers to swap ideas on how to get the most out of an automobile.

I'll also pass along the views of some interesting people who helped prepare this guide by attending a special meeting. We called it a "Conference of Car Keepers," and it brought together six people who, despite very different backgrounds, all shared an exceptional interest in long car life.

Q. What's the secret of long car life?

A. There's really no secret; do it by the book. Read the owner's manual that came with the car and follow the service recommendations in it.

This isn't an oversimplification. Everybody at the conference agreed the owner's manual advice will go a long way toward preventing last-straw repairs.

But that advice is often ignored. I think there are two main reasons why. One, people think the manual is just for do-it-yourselfers who work on their own cars. Or two, they think it's trying to sell them a lot of service the car really doesn't need. Wrong on both counts.

Q. Are oil changes really so important?

A. Yes, because oil eventually "*wears out*", its additives get used up. The camshaft and other parts can be damaged when the antiwear additive is all gone. Sludge and

deposits can build up fast after the detergent has been used up. When the antioxidant is gone, the oil can become too thick.

I look at it this way. A typical car owner who changes oil when he should and adds oil when he needs to can expect to use less than $200 worth of oil and filters in 100,000 miles of driving. Very cheap insurance.

Q. Will the recommended service be the same under all conditions?

A. No. The way you drive and the climate make a difference.

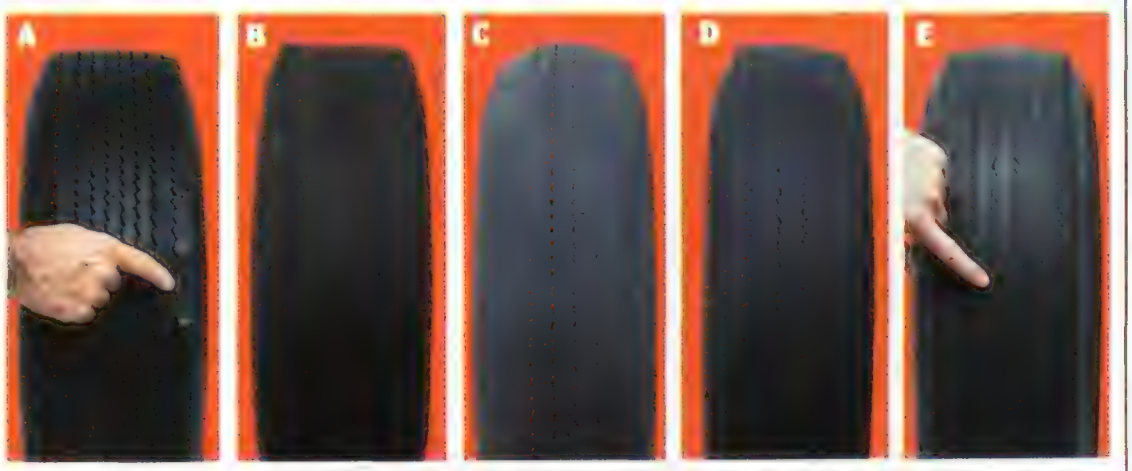
For *severe service* your car will need more frequent changes of oil and transmission fluid than for normal service. That doesn't just mean driving across deserts. Stop-and-go driving in cold weather is one of the toughest kinds of "severe service."

The automotive engineer at our conference pointed out that, "Severe service includes those of us who make a lot of *short* trips to the store or to work. The engine doesn't have time to warm up fully, and that makes for faster wear."

How much you drive also makes a difference. Service is recommended at a certain mileage *or* time, whichever comes first. If you don't run up a lot of miles, service your car by the time interval. It's just as important as the mileage interval.

Climate can make a big difference too. In Northern cities road deicing salt can rust the underneath of your car. Wash your car frequently and hose off the underside of the chassis and wheel wells. You might invest in a rust-proofing by one of the companies that specialize in it.

If you live in an area where the summers are real scorchers, pay special attention to the cooling system. One bad overheating can plant the seeds of a last-straw repair that can finish off your engine before its time.



The price of a new set of tires can be the last straw. Stretch tire life by avoiding common tire killers. **A.** *Weak shocks or out-of-balance wheels can cause bald spots or cupping.* **B.** *Overinflation can cause the center of the tread to wear faster than the edges.* **C.** *When edges wear faster than the center, it's probably due to underinflation or hard cornering.* **D.** *Wheel misalignment can cause one edge of the tread to wear faster.* **E.** *Tread wear indicator shows it's time to change, but tire wore evenly, allowing for maximum life.*

"We don't quibble about preventive maintenance. A $30 transmission service may save a $400 overhaul."
Al Golub, President, Chicago Limousine Service

Q. Which maintenance jobs are the most important?

A. All of the service recommendations in your owner's manual are good to do. But several of them are especially important because they may be related to last-straw repairs. The chart below gives examples:

Last-straw repairs like these	*...might be prevented or delayed by maintenance jobs like these...*
Complete overhaul of engine	Check oil Change oil Check drive belts Check hoses Test cooling system for leaks
Transmission overhaul	Check transmission fluid level and add as necessary Change transmission fluid and filter
Replace piston rings and bearings	Change air filter Change oil and oil filter
Valve job	Adjust valves (where required)
Turn down or replace brake drums and/or rotors	Check brake linings and/or pads and replace as needed
Front end overhaul including new ball joints, and tie rod ends	Lubricate chassis
Repair severe rust damage to body and frame	Flush underbody with water to remove road salt

Q. How can I keep my car from showing its age?

A. A car can show its years in the way it looks and the way it sounds.

You can fight both.

Looks: Give your car a good wash with cool water and mild soap. Do it in the shade.

Wash vinyl top with mild soap, lukewarm water, and a soft-bristle brush, followed by a vinyl top dressing. If it has a rip, mend it with a vinyl repair kit.

Touch-up paint on chips and scratches does a little for looks and a lot for rust prevention.

Sounds: If your car sounds like an army tank,there might be a serious problem, but most squeaks and rattles aren't serious.

Use a spray lubricant on hinges of doors, hood, and trunk. Noises from bumpers, fenders, or grille might be caused by loose bolts. If the noise sounds as if it's coming from underneath, have a mechanic put the car on a lift and inspect the exhaust system for loose fasteners.

Squealing can mean a loose drive belt. Loud roaring probably means a hole in the muffler.

Other noises might signal more serious problems and should be checked by someone who really knows cars.

Q. When is the most economical time to trade in a car?

A. There's no way to say for sure, but it's safe to say this: Even *with* the added maintenance and repair that an old car needs, it's usually cheaper to keep it than trade it in on a new one.

I often hear people say, "I'm spending so much on repairs, it would be cheaper to just go ahead and buy a new car." But when you actually put a calculator to it, that statement is hardly ever true.

Study the chart below. Your costs will be different, but you'll get an idea of the economics of buying a new car versus keeping the one you have.

Q. Does that mean it's not a good idea to buy a new car?

A. Of course not. The example shows that even with repairs, it can be significantly cheaper to hang on to an old car. But that doesn't mean you're throwing money away if you decide on the new one.

The new car probably offers comfort and pleasure that the old car lost long ago. If the old car hasn't been kept up all along, a new car will probably be more reliable. And while it's hard to put a dollar figure on pride of ownership, that's definitely worth something.

Remember too, if your new car gets better mileage, you're saving energy for all of us.

KEEP IT RUNNING VERSUS TRADE IT IN

These figures are based on 1978 and 1982 six-cylinder four-door sedans. The older car originally cost $5,610 and gets 18 miles per gallon. The new car cost $9,021 and gets 19.5 miles per gallon. Our figures are based on certain assumptions. Your cost should be estimated according to your circumstances.*

	Year One		Year Two		Year Three		Year Four		Four-Year Total	
	Old	New	Old	New	Old	New	Old	New	Old	New
Car Payment Principal[1]	$—	$1097	$—	$1312	$ —	$1569	$ —	$1876	$ —	$ 5854
Interest on Car Loan[2]	—	966	—	751	—	495	—	188	—	2400
Gasoline and Oil[3]	1104	1021	1104	1021	1104	1021	1104	1021	4416	4084
Insurance[4]	447	583	421	552	421	543	421	506	1710	2184
Repairs, Maintenance, Tires[5]	164	66	653	186	312	578	388	200	1517	1030
Resale Value of the Car	2610[6]	7297	2053	5920	1496	4543	939	3166		
Total expenses									7643	15,552
Minus final resale value of car									-939	-3166
Actual Cost									6704	12,386
Difference									$5682	

***Footnotes**

1) Assume the older car is paid off. The total car payment principal ($5854) equals the cost of the new car at the beginning of year one ($9021) minus the resale value of the older car at the beginning of year one ($3167) which is used for down payment.

2) The interest is calculated for four years at 18% and would be tax-deductible.

3) Based on 15,000 miles, gasoline priced at $1.30 per gallon.

4) $100 deductible comprehensive, $250 deductible collision, $50M property damage, $100/300M bodily injury.

5) Covers all normal repair, replacement and preventive maintenance. Costs are significantly higher for years in which tires are replaced.

6) At the end of year one.

Data developed for Shell by Runzheimer and Company, Inc., International Management Consultants for Travel and Living Cost, Rochester, Wisconsin.

Lift these advertising pages out by removing staples

"I change oil on schedule; every five thousand miles in my new Olds diesel, every four hours in the race car."

Harold Elliott, Chief Mechanic for 3-time NASCAR champion Cale Yarborough.

Q. What should I look for in a new car if I plan to keep it for a long time?

A. Spend the money to get a car that really serves your purposes. For example, if you sometimes tow a boat, it will probably pay you to get an optional "towing package" on your car. It includes things like a larger radiator, heavy-duty rear suspension, bigger battery, and extra transmission fluid cooler.

If you want air conditioning, get it factory-installed rather than add-on. A new car that has factory air is usually designed with a larger fan and radiator to keep the air conditioner from overheating the engine.

Q. Isn't it good for the engine to let it warm up a long time?

A. Cold running is hard on an engine, but, ironically, the engine will warm up faster if you don't "warm it up." Let me explain.

"Warm up" usually means letting the car sit and idle for a while. But the engine will actually get up to operating temperature faster if you start driving, making the engine do some work.

For both engine protection and fuel economy, start driving as soon as the oil pressure light is out and the engine is running smoothly.

Q. How can I remember when my car needs maintenance?

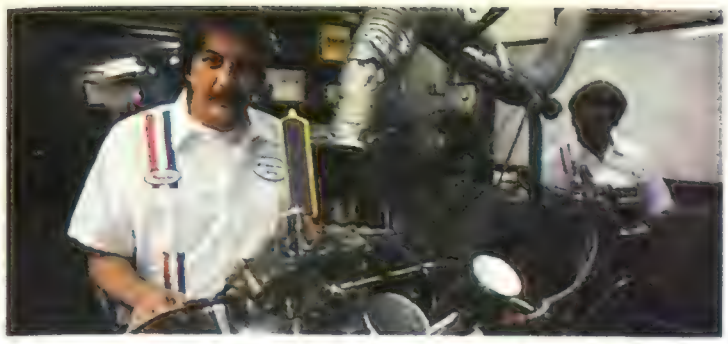
A. To take first-class care of a car, do what taxi and limousine operators do—keep a written record of all maintenance so you'll know when to do it again. (Written records may help a little at trade-in time, too.)

Whenever maintenance work is done, write down the date, the mileage, the job that was done, and when it needs to be done again.

Some service stations and garages will keep records for you.

Many owner's manuals have space to do your own record keeping. If yours doesn't, a notebook or envelope in the glove box will do. (See below.)

Free at participating Shell Dealers. *A Maintenance Record File to help you keep accurate records of all maintenance. It has a chart for the service job, date, and mileage; and a handy envelope to store receipts.*

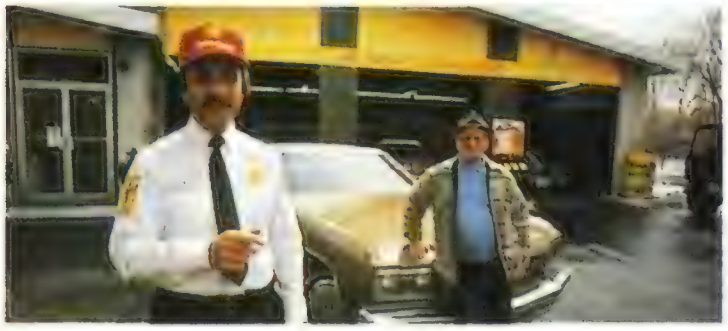


Harold Elliott, Chief Mechanic for 3-time NASCAR champion Cale Yarborough: "If you pump your own gas to save money, make sure somebody gets under the hood every now and then to check drive belts and fluid levels. That might save you a ***lot*** *of money."*

Jim Nash, Superintendent of Maintenance, Yellow Cab Company, Chicago: "Our cabs average 150,000 miles. That's average. *One reason is the detailed, written records we keep. We know the vehicle is getting the maintenance it needs."*

Robert Rarey, automotive design engineer-consultant: "The people who design the car also determine what goes into the owner's manual maintenance section. So you're getting very valuable information there. They know what the car really needs."

Katie Robbins, President, Classic Car Club of America: "I have one secret of long car life that I keep in the trunk—a clipboard full of written maintenance records."



Jim Jaskoske, Shell Auto Care Dealer, with customer Yvan LaPointe: "Yvan is religious about regular maintenance. That's one reason his car has gone 103,000 miles without any major repairs. And he's still not thinking about trade-in."

"Regular service for your car is an *investment*."
Jim Jaskoske, Shell Auto Care Dealer

Oil--vital to your car's long life

Change your engine oil regularly as recommended and be sure to use the right oil. Shell recommends **Shell Fire & Ice**® Motor Oils. They are formulated to protect engines in cold and hot-running service and help speed start-ups on frigid mornings. They are formulated to save gasoline, too.

About the Author

Jim Jaskoske has worked in a service station ever since he was 16 years old. He's owned and operated a Shell Auto Care Station for 12 years in Oak Park, Ill., near Chicago. Jim has been cited for excellent service by Shell's Chicago North District every year he's been in business.

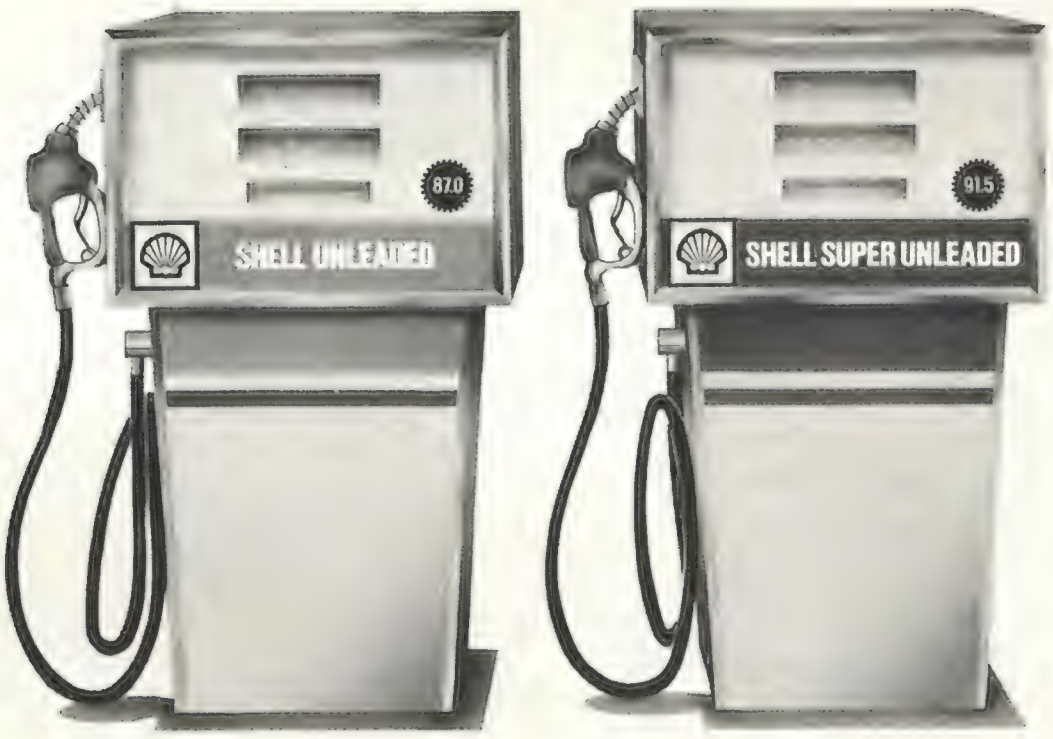
***FREE** at participating Shell stations: the **Auto Maintenance Record File.** It's an easy way to keep preventive maintenance records.*

SHELL AUTO MAINTENANCE RECORD FILE

© 1982 Shell Oil Company

Come to Shell for answers

One of Shell's unleaded gasolines is better for your car.



Here's how to choose it.

Unleaded gasolines are not all alike. Shell offers you two unleaded gasolines, each with its own advantages.

If your car *requires* a higher octane, higher performance premium gasoline, Shell Super Unleaded is the better choice.

Its extra octane (about 91.5) helps prevent knocking and "dieseling" (a sputtering which can continue for a short while after you've turned off the ignition).

But not all cars require that high an octane number. Many will run just fine on an unleaded gasoline with a lower octane.

That's why Shell offers you Shell Unleaded (about 87 octane). It costs less. So if it does the job well, it's the better choice for your car.

Here's a suggestion. Why not try *both* these fine Shell gasolines? Pay attention to the performance you get. Then pick the one that's better for you and your car.

Note: Both contain an effective detergent package to keep your carburetor clean.

Come to Shell for answers

By Jane Wholey

Saving London from an impending threat of flood

A vast engineering project—the Thames Barrier—will provide ingenious protection for a metropolis in danger of drowning

There is nothing new about the Thames River topping its banks. Samuel Pepys noted in his diary on December 7, 1663, that "there was the last night the greatest tide that ever was remembered in England to have been in this river: all White Hall having been drowned. . . ." But lately, the specter of devastation by a major flood has fastened like a barnacle onto the consciousness of modern Londoners. For good reason.

London is sinking. And while Britain's capital descends a foot per century into its bed of clay, the entire island comprised of England, Scotland and Wales is tilting into the sea, the southeast corner where London is situated leading the way. This rising of the water level is compounded not only by sinking and tilting but by something else—the current melting of the polar ice caps. All three factors combined have caused a full two-and-a-half-foot rise in high tides at London Bridge during the past hundred years.

As a result, the stage is set for a deluge quite as devastating as anything Samuel Pepys could dream up —worse than the Great Fire of London and the Black Plague put together. A very severe tidal surge would inundate up to 45 square miles, affect 1.25 million Londoners and leave behind a residue of stinking, disease-rich muck. Restoring the subway system alone could take months.

The Greater London Council (GLC) estimates the potential property damage at $8 billion, but that is merely the tip of the iceberg, so to speak. No one has begun to put a price tag on the nationwide, indeed global, disruptions that could ensue from engulfing so huge a center of communications, culture and finance.

If London were to drown, it would be the aftermath of a visit from a North Sea "surge" tide, a freak tide that occasionally swells up the Thames. The surge is not a recent phenomenon; it is probably as old as the Thames itself. But now that high-tide levels are rising, an ancient menace has vastly intensified.

The surge starts innocently enough as a low-pressure pocket traveling the Atlantic with a hump of water sucked up beneath it. When the configuration passes north of the British Isles and turns south into the comparatively shallow, funnel-shaped North Sea, the water level mounts. The next available waterway is the Thames, at the funnel's skinny neck. If the surge enters at spring tide, with strong winds riding at the back, London is primed for disaster. What are the chances that these disparate conditions will coincide? Experts say the odds are one in 50 each year.

Until December of this year, that is. Protecting London by that date will be a movable barrier as colossal as it is unique in the history of flood prevention: the Thames Barrier, as the sponsoring GLC named it matter-of-factly. Judged by the size of the gates, it is the largest movable water barrier on Earth. It also is the keystone of a $1.3-billion flood-defense system that stretches all the way to the mouth of the Thames. Once it is operational, umbrellas should be sufficient protection against inundation in London, at least until the year 2030, when it is conceded that the barrier may have begun to fray a little around the edges.

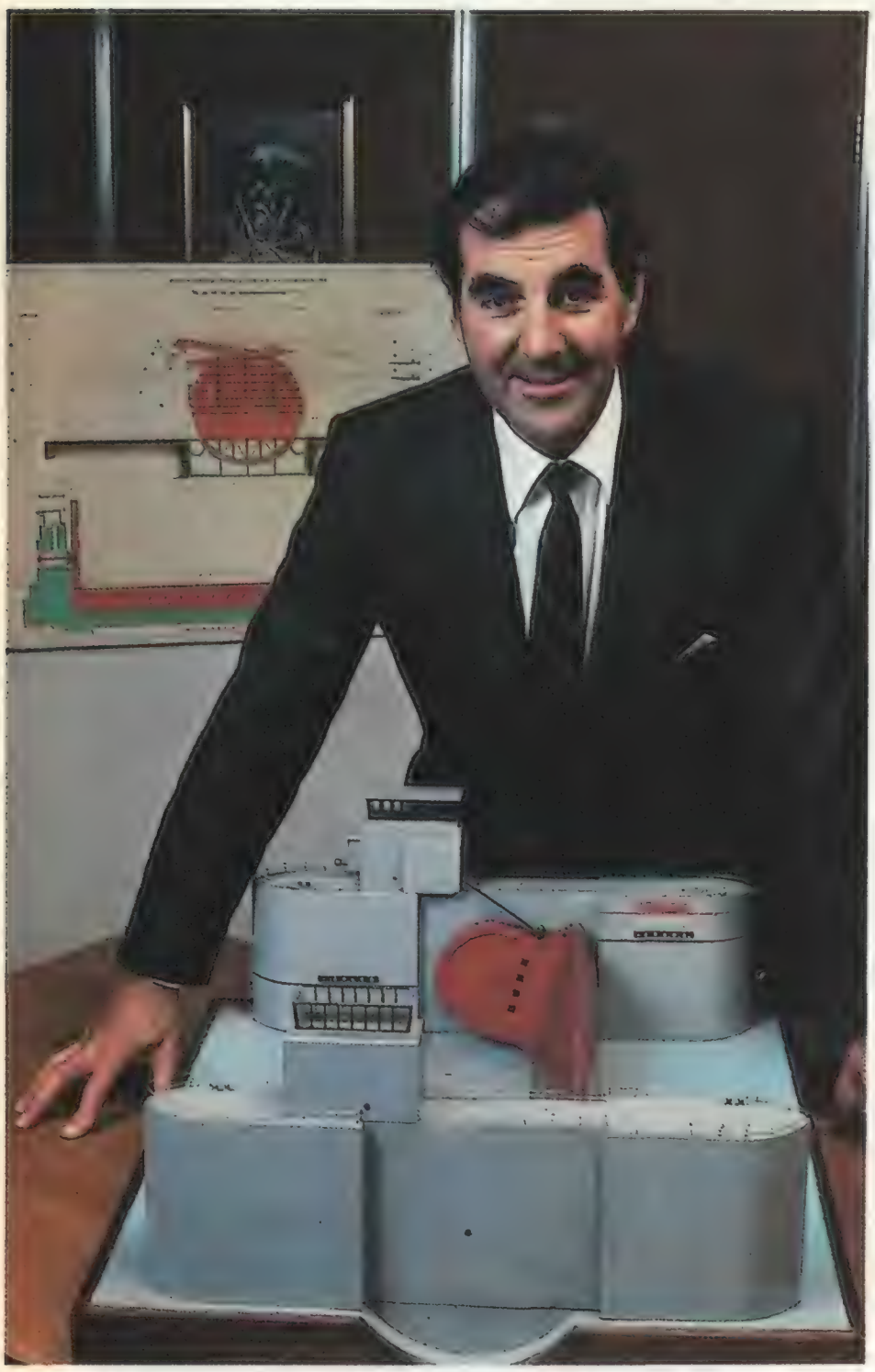
The main work site is at Woolwich Reach, eight miles as the crow flies downriver east of Parliament Square. From the air (opposite), it looks like a string of quilted, stainless-steel scuff slippers with concrete soles. From the riverbank, it appears more like a lineup of glittery centurion helmets minus the plumes.

The construction spills onto both riverbanks—gatehouses and control, generator and workshop buildings. Fanning out from there is a straggly fringe of makeshift buildings that house offices, canteens and machine shops. These form the temporary support system that allows 1,500 people to work on the barrier round the clock, five days a week, with weekend crews for equipment maintenance. They have been at it for eight years now.

On a recent visit to the second-story office of one faceless temporary building, I found John Shaw poring over details of the next day's work, a sill-sinking operation. Shaw is superintendent of the divers on the

Under construction, Thames Barrier has two of its curved floodgates in place, temporarily above water.

Photographs by Adam Woolfitt



Engineer Charles Draper shows off model of rotating floodgate he invented, on principle of a gas cock.

project, more than 100 of them. In sinking the 10,000-ton sills—berths for the giant floodgates—they have played a pivotal role.

Shaw is self-trained, young and ambitious, one of the original divers hired to work this site in 1974. Today he manages what is thought to be the largest diving contract anywhere in Europe. The job has posed many more challenges than just coordinating a platoon of wet suits. Coping with zero visibility under water, for instance. Shaw had to teach each man to think as if he were blind, to crawl along the river bottom in the silty murk and check every square inch of dredging work by fingertip. Later, under these same obscure conditions, divers would learn to cut away steel piles using underwater torches, and to cut through stubborn limestone with water jets powerful enough to sever human limbs.

In a building across the road, Dutch-speaking voices waft from a conference room filled with employees of Hollandsche Beton Maatschappij (HBM), one of three contracting companies that make up the main civil-works consortium. ("Civil works" are the major static structures such as sills and piers; "mechanical works" refers to elements that move, *e.g.*, hydraulically operated machinery for the gates.) The Dutchmen also are talking about the sill-sinking process. Deputy chief engineer Wim Jonker is the leader, his longish blond hair and brown corduroy Levi's belie the position of authority he holds here, which includes managing most of the large construction machinery on the site.

Million-dollar 'Popeye' with a 'ripper tooth'

When the Dutch say large machinery, they mean *large*. HBM, for instance, owns a million-dollar, 900-ton floating dredger called the "Popeye." With its single "ripper tooth," it can bob down and shred a riverbank 75 feet below water level. It even has a living room and four sleeping cabins inside.

The next day's work will be an exacting venture even for the old Dutch hands at HBM, men who hail from a nation that definitely knows about water. During the sill sinking, 20 emergency measures must be at the ready in case of equipment breakdowns. If a sill lands more than one-half inch off its target between the piers, the mission will have flopped.

The construction site looks like a beehive of flapping clothes and plastic hard hats. The bone-chilling winds do not let up, but no one pays them much attention. For most of the crane operators, machinists, welders, electricians, carpenters and watermen who help make up the work force here, this is just another shift in a seemingly endless construction odyssey.

London's flood barrier is of course much more than that, even more than one of the largest assemblies of

Artist's concept shows cutaway of Thames Barrier in operation, with a curved "rising-sector gate" lifted into vertical position to block river surge; upstream water level (at left) is lower than it is downstream.

hydraulic machinery ever installed in a river. It is a part of a long history of brilliant British engineering projects including some of the world's most beautiful bridges and the first railroad, as well as the Crystal Palace. And, like the pyramids of Egypt or the U.S. interstate-highway system, it is the expression of an entire era. Archaeologists who give the project a close reading eons from now will learn quite a bit about the society that designed it.

Most of the structures at Woolwich Reach should make immediate sense to future observers, except, perhaps, those odd quarter-moon-shaped floodgates, the ones that are concealed underwater but are capable of swinging into a vertical position five stories high. Why had the GLC gone to such trouble? Why not a tried-and-true dam with locks? Thereby, the archaeologists will learn, hangs a long saga in the annals of 20th-century engineering, one that twisted and turned for two decades before construction crews sank a single piling.

The drama began in 1953, when a Parliamentary committee investigated methods for halting the perennial flood damage after a surge tide burst defenses on the North Sea, drowning 300 people on the east coast of England, and nearly topping the flood walls along the Thames. Members decided that the traditional approach—heightening the riverbanks—would no longer suffice in and of itself. The beloved Thames was disappearing from view. Building a permanent dam had been rejected earlier because of dangers posed by an air attack and problems of siltation and pollution.

A structure that would not impound the river—one with openings that could be closed by gates to form a barrier in an emergency—seemed a good idea. The Port of London Authority and other local shipping interests agreed, but insisted that openings in the barrier should not inhibit river traffic. By the 1960s, containerism had ushered in an era of bigger ships. The capital had failed to enlarge its port, and once-active docks were rotting away.

Still, London's shipping interests were powerful enough to make their opinions heard. A number of plans were drawn up and rejected until, finally, in 1970 (17 years after the original government investigation), all parties agreed on the Woolwich site and floodgates 200 feet wide. Members of Parliament

Jane Wholey, a freelance writer who lives in New York, frequently reports on energy and urban technology.

Workers on construction site take a tea break; where to take it provoked an early, bitter labor dispute.

heaved a sigh of relief and asked the GLC's Department of Public Health Engineering if it would like to take over the project.

According to Ray W. Horner, the department's deputy director and the GLC's chief engineer for rivers until his recent retirement, the GLC was only too glad to accept, on one condition: that it be given power to carry the scheme of its choice all the way to completion. Parliament gave tacit approval to the proposals, but with the understanding that Horner and his fellow engineers would come back with an airtight plan that could be written into law.

Horner's team (engineers from the GLC as well as from Rendel Palmer & Tritton, and Sir Bruce White, Wolfe Barry and Partners—two firms involved from the beginning) spent a year researching the possibilities. During that time, they went to work on a 380-foot, $200,000 concrete model of the Thames. That helped them to brainstorm barrier options that ranged all the way from the sublime to, as Horner puts it, "the jolly ridiculous."

The permanent-dam concept came up again, but was buried for good because of the siltation problem. So if a dam would not do, the engineers reasoned, how about blasting in a load of muddy goop to stop up the river temporarily? Might work, but how would you unplug the waters afterward? Scratch that one. Perhaps underwater pipes circulating cold brine? Freeze part of the river like a skating rink. . . .

As one after another of the alternatives was eliminated, the engineers saw that the technically sensible approaches were depressingly few. By December 1970, the team had decided by default on drop gates, long flat slabs that would hang in the air suspended from 300-foot towers.

One young team member, engineer R. Charles Draper of Rendel Palmer & Tritton, left for Christmas

Under the Thames, construction worker puts finishing touches on paint job in the main service tunnel.

Working at night, floating cranes lower a disklike, rotating "gate arm" into place alongside one of piers.

feeling rather depressed. It was a horrifying thing, he thought, this gate they had designed in the sky. The Thames was sacred, one of London's greatest treasures. Defiling it with a grim metal billboard was like plopping a gas station on top of Buckingham Palace. But what else could you do?

Cleaning up holiday decorations in his combination party room-garage one day, Charlie Draper's eye fell on the gas meter and, beside it, the gas cock. In his mind's eye he saw the gas cock in cross section: a cylindrical piece of metal with a hole bored through it from side to side, sitting crosswise in the pipe. He imagined the cock in the "on" position, hole facing the bore of the pipe, gas pouring through. Then he saw it in the "off" position, hole rotated 90 degrees, facing the floor.

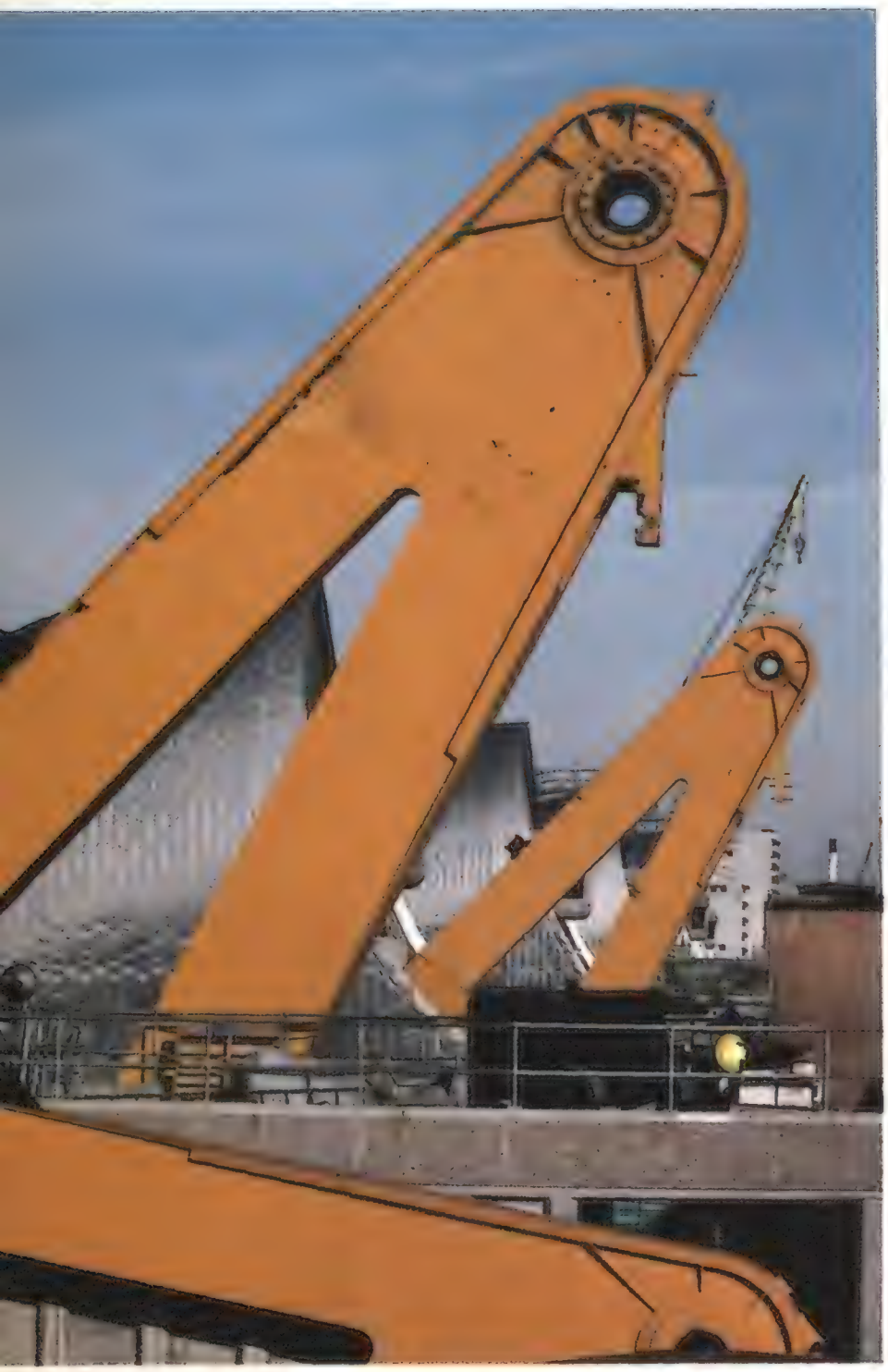
Suddenly, Draper flashed on another picture, a floodgate that looked like a giant slice of the gas cock, rounded on one side, flat on the other, hung between two disks. The gates could rest out of view in the water until the disks rotated them up to the vertical position, curved side facing the flood. From an engineering standpoint, the arc shape was very practical indeed. The gate could be moved with minimum effort for its size; it would withstand water pressure even better than a straight slab.

Draper gathered up some Celluloid scraps from his Christmas tree and fashioned a replica of the gate. He put bricks on either side of it and stood on top. "Not bad," he said to himself. A day later, with his boss' permission to stay home, Draper was hunched down on the garage floor with a heap of odd parts from a neighborhood child's Erector set, some wood and paint. He built two working models: one that demonstrated his gate idea; the other, the barrier the GLC intended to build. He packed them into his Land Rover and drove to the office.

"This is what you want to build," Draper told engineers gathered around the table. "And *this*"—he cranked a tiny handle that swung up a red cardboard piece that resembled a snowplow blade—"is what you ought to build."

There was little debate at the GLC. Like most great ideas, its genius lay in its simplicity. It was obvious. It would work.

Nearly 11 years and many demonstrations later, that same model today sits on prominent display in Draper's office. "A bit beaten up," he quips, with characteristic good cheer. He wears a blue tie with a cross section of the floodgate on it, his own design. Down



Huge rocker beams, not yet connected to gate arms, provide lift mechanism to rotate floodgates upward.

at the site, I later see some of the project engineers sporting similar neckware.

There were many bridges to cross between Draper's brainstorm and the barrier installation. The first was the Thames River Barrier and Flood Prevention Act, passed in August 1972, which gave official sanction to the "rising-sector gate." Next came an interim bank-raising project to buy time and to fortify the city's vital organs in case a flood erupted before 1979—the earliest, the GLC reckoned, the barrier would be finished. Construction got started at Woolwich Reach in July 1974.

The staging area for the most critical of all the barrier's components was at the other end of England, the northeast, in Darlington and Port Clarence. There, the Cleveland Bridge and Engineering Company, part of the Davy Cleveland Barrier Consortium, fabricated all ten steel gates (six rising-sector gates for the barrier's navigational channels, four falling-radial gates for the flanks). Cleveland Bridge's manager for the barrier project, Phillip Harvey, says that back in 1974 there was simply no precedent for the tasks that lay ahead. Who had ever built an offshore, hydraulically operated device that weighed 3,000 tons?

Thirty miles of welding per gate

One of the biggest challenges in building the rising-sector gates turned out to be the precise measurements required. No more than three-eighths of an inch off the blueprint dimensions was acceptable. Complicating matters, there was welding to do: 18 months and approximately 30 miles of it per rising-sector gate. Welding inevitably means shrinking steel; how much per job is almost impossible to predict. Nonetheless, Cleveland Bridge rose to the occasion.

Welded together, each gate looked rather like a Quonset hut, big enough to have accommodated many spacious apartments in its hollow interior, and larger than any existing building on the lot. When painting time came, Cleveland Bridge simply built dustproof sheds around the gates. An almost antiseptic environment, complete with dehumidifiers, was essential because of the special paint involved. At $400,000 for paint per gate, not one of them could end up with a trace of grit.

The solvent-free epoxy had been discovered in the United States; pure plastic, actually. Its advantages lay in the tough, glossy finish it promised—better than that of a new car—and in just one coat. But the liquid had to be dragged along by each painter in an exotic machine called a "Hydracat" that heated and sprayed simultaneously. If temperatures dipped below 65 degrees F for four minutes, the stuff would go solid.

Six months of spray paint later, the first rising-sector

gate was ready to ship out. Great advances had been made in transporting massive waterborne equipment, thanks to the North Sea oil enterprises, and this step was not a problem. A crew of men tucked a bed of "bogies" (low, strongly built carts) with more than 600 wheels among them under the gate and hooked this rig behind four tractors. These hauled the gate to the river, where it was winched onto a barge.

Back at the barrier site in Woolwich Reach, technical problems had bollixed things up almost immediately when the limestone beneath the riverbed became a major issue. Driving steel piles into the substance was about as successful as ramming toothpicks into cement. Finally, the civil-engineering-works contractors, an Anglo-Dutch consortium calling itself Costain-Tarmac, Hollandsche Beton Maatschappij (CTH), found the solution in a baroque combination of equipment: auger drills, air lifts, "Trencha" grabs (big cranes for excavating trenches). They even resorted to explosives. The site turned into a forest of floating cranes.

The sheet piles were crucial, the very bones of the barrier from which the temporary structures would grow. In offshore construction, temporary works like access roads and cofferdams (watertight boxes built down to the riverbed) can be time-consuming and expensive to build. The barrier was no exception, and understandably so. The nine cofferdams constructed were the largest in Europe, each one big enough to swallow 400 double-decker buses.

Barges carry gate arms upstream toward the barrier from Port Clarence, on northeast seaboard of England.

Pouring concrete for 100 hours straight

Building the cofferdams was an adventure. After driving in the piles, and before dewatering the internal space that they defined, it was necessary to pump in a 16-foot concrete "plug." This took 100 hours of continuous pouring of concrete (14,000 tons), followed by an intense struggle against seepage pressure. Nine months of delays seeped into the project before the contractors could move on.

Ultimately, the piers were built right there inside the cofferdams. Then the work shaft was reflooded and the piles cut away by divers using underwater torches. In place of the cofferdams stood nine oval-shaped piers, 165 feet high, 214 feet long. Inside each was an electrical-control room, machinery rooms, passageways, elevator, several flights of stairs and enough concrete to pave nearly a mile of highway six lanes wide.

The technical puzzles involved in building these structures were not the only problems to solve at the barrier. There were plenty of labor difficulties, too. According to Frank G. Byrne of the Transport & General Workers' Union, the largest of six trade unions represented on the site, things started on the wrong

Divers on project have had some tasks in water so murky they worked by fingertip, feeling as if blind.

Along Thames at Strand-on-the-Green, doorways are high above street as safeguard against flooding.

foot immediately. The civil-engineering contractors had purposely hired a large percentage of nonunion workers. The conflicts that later erupted ("No more, no less than average for a large construction site," says Byrne) mainly had to do with bread-and-butter issues: severance pay, overtime, bonuses. But some involved abstract matters of principle such as human dignity. And in these largely symbolic struggles, the deep mistrust between England's management and laboring classes was evident.

Take the tea-cart episode. As Roger Ferdinand, shop steward for Transport & General tells it: "You had men working 50 feet down in the cofferdams. To get to the top, they'd have to climb 16 or 17 ladders, and from the top of the less-accessible piers, it could take three-quarters of an hour to get to the canteen. This was for a ten-minute tea break" (p. 82). Management tried to solve the problem by rolling tea carts down onto the piers. They figured that workers could grab a bite, then have their snacks below. Labor was indignant. "We are not animals," says Ferdinand. "We refused to eat in the cofferdams."

But labor problems continued. Neil Davies, a GLC councillor and former chairman of the Thames Barrier subcommittee, comments on those gloomy days: "The whole project seemed to be grinding to a halt. We thought the barrier might never be completed. The project needed some sort of dramatic unplugging of the drain."

But how to do it? Money had become a serious problem. By 1978, inflation had increased the cost well over 80 percent; the most recent estimate for the completed barrier project (including a bank-raising cost of $115 million) is close to $800 million.

Still, considering all the alternatives, the most hopeful strategy the GLC could conjure up involved spending even more money—offering nearly $30 million in bonuses for timely completion of the project.

Some of this money had to be shared with the workers. In return for labor's cooperation in meeting the new deadline, every worker on the site who stayed to the finish, canteen and office workers alike, could get a bonus as high as $7,000. The deal was one of the largest labor settlements ever made in British history and it worked, moving construction ahead on schedule.

When the barrier goes into operation this winter, it will represent a joyous landmark for London. For until then the city remains vulnerable and Londoners remain ready, at word of any Atlantic or North Sea storm, to reach for their rubber boots.

Steel hoods of piers struck some engineers as too flashy, like "chicken carcasses wrapped in tinfoil."

dimension

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The knowledge business

By Andrea Oppenheimer Dean

An architect who puts 9-to-5 workers in 'family rooms'

Kevin Roche wins his profession's highest award for achievements that make him a leading exponent of the Modern tradition

Roche with model of DeWitt Wallace Museum his firm has designed for Colonial Williamsburg, Virginia.

Modern architecture, according to many critics, is dead, a victim of its own misguided zeal. Its successor, they say, is Post-Modernism, which seeks to restore a broader range of architectural forms and meanings through use of ornament, cultural symbols and historical references, all of which the Modernists had discarded. But so far, Post-Modernism has given us more drawings and polemics about style than major new buildings, most of which remain rooted in broadly modern ideals and esthetics. As Eero Saarinen, perhaps the most influential second-generation Modernist, once said about pronouncements of instant history, critics "who work in rabbit time don't understand . . . that the practice of architecture has to be measured in elephant time."

Saarinen himself prepared the ground for today's new design directions, and if the work of his firm's successor, Kevin Roche John Dinkeloo and Associates, is any indication, modern architecture has with time matured. Kevin Roche won this year's coveted international Pritzker Architecture Prize, which annually bestows on its winner not only great esteem, but also an award of $100,000 and a specially commissioned sculpture by Henry Moore. Roche is using the money to help endow a chair in the name of Saarinen at Yale.

Flanking their soaring atrium in New York, Ford Foundation employees have fine views of each other.

When Saarinen died suddenly at the age of 51 in 1961, Kevin Roche, his chief design associate, and John Dinkeloo, in charge of the firm's technical development, completed their mentor's unfinished designs. Among these were the granite-clad, brooding presence of the CBS tower in Manhattan, Dulles International Airport outside Washington, D.C., and the John Deere & Company's Moline, Illinois, administrative center, which takes its responsibility to provide a good workplace as seriously as esthetics. With these and other buildings, Saarinen challenged the purist orthodoxies of 1950s architecture. He approached every new project as a puzzle requiring a careful piecing together of the specific needs of functions, users, clients and site. The result was a new variety in form and shapes. It is an inheritance that Kevin Roche and John Dinkeloo have enlarged. They adopted the approach of trying to make the world as it is more livable, humane and interesting.

Kevin Roche is a soft-spoken, reserved and modest man with a sense of humor well in place. He was born 60 years ago in Dublin, educated at the National University of Ireland and then employed briefly in Irish and English architectural offices before coming to the United States in 1948 to study under Mies van der Rohe at the Illinois Institute of Technology. After a tour of the United States, he ended up broke in Manhattan, where he found work in the architectural office of the United Nations, but was laid off at Christmas 1950. "It was," he says, "a time of minor depression

Roche leads architecture in new directions

for architects." Through an acquaintance he met Saarinen, who hired him.

"Now Eero," says Roche, "wasn't the kind of person who could be contained by limited esthetic classifications." Roche's own varied and highly individualistic buildings similarly defy categorization. When asked about his own esthetics, the meaning of his forms, their relationship to historical precedents or current trends, Roche becomes even quieter than his quiet self. He has a habit of aborting unwelcome discussions by shutting his light-blue eyes and rubbing both hands over his oddly unlined face as though wiping away a headache or other annoyance. "What I have never understood in the work of many architects, including so-called Post-Modernists," he explains, "is that they write the same poem over and over again, in the same meter and style. I'm suspicious of styles because they are formulas, overlays of the latest fashion."

John Dinkeloo was as unassuming as his partner, though more easygoing, extroverted and unflappable. He died last summer at 63. His imaginative ways with things technical and structural helped change the face, or at least some of the features, of recent design. One of his developments, reflective glass to reduce heat gain, became the stock-in-trade of fashionable high-tech architects. He was the first to use weathering steel in architectural construction, and from the auto industry he borrowed neoprene gaskets and pioneered their use in sealing curtain-wall systems.

Saarinen, just before his own death, made arrangements to move his practice into a burly Victorian mansion in Hamden, Connecticut, which still serves as Roche Dinkeloo's offices. It was built by a German cigar manufacturer who, it is said, wanted a kind of castle on the Rhine, which it strongly resembles, perched on a hill overlooking the reservoir of Whitneyville. Inside, things are unusually calm, detached and orderly. Nearby, inventor Eli Whitney's former stable has been converted into a pleasant house where Roche lives with his wife, five children, dog and cat.

The firm's first independent commission came in 1961 and influenced prevailing attitudes about urban design. The city of Oakland, California, laboring under Gertrude Stein's indictment that "there is no there there," wanted a grand museum to give it a centerpiece and put it on the cultural map. About 37 architects were contending for the job. But, before Saarinen could be interviewed, he was stricken by a brain tumor and died within a month. "We were automatically taken off the list," recalls Roche, "until Esther Fuller, a member of the museum commission, insisted that we were at least entitled to an interview."

Roche won the commission by persuading the clients that their barren downtown with scattered, bullying buildings needed not an arid monument, but a park with a structure beneath it to serve as a community meeting place. It was a radical idea for a city

The author, who is a senior editor at the AIA Journal, *wrote about architect Luis Barragán, an earlier Pritzker winner, in November 1980* SMITHSONIAN.

These pyramidlike blocks, designed for College Life, are monuments to Roche Dinkeloo's invention.

Intended as a comfortable workplace, John Deere addition near Moline surrounds a vast interior garden.

that wanted an assertive image at a time when towering blockbusters were the order of the day. Most of the four-block complex is tucked beneath concrete terraces, with 20-inch-high walls to sit on, stepped to form roof gardens for the levels below. Its structures are linked by staircases, walks and intersecting plazas.

While the Oakland Museum created a garden outside, Roche Dinkeloo's first office building, the 1967 Ford Foundation headquarters in Manhattan (p. 90), puts the greenery inside in a huge, lush, glass-enclosed court, taller than the nave of Amiens Cathedral. It was a forerunner of today's bumper crop of light- and plant-filled atrium spaces that now serve as focal points for hotels, shopping centers and office buildings from coast to coast. But the atrium solution, says Roche, "came through the back door as a result of a series of other decisions." These focused on two main questions, largely ignored by architects at the time: How could the designer create an environment in which employees could be comfortable, physically and psychologically? And how could the building be made to fit respectfully into its neighborhood, while making a contribution to it?

The Ford Foundation had been occupying ten floors in a typical high-rise building and, as Roche says, "what happens in that kind of space is that you get into an elevator to go up to the floor you're working on, get out, go to your office and probably never see, much less get to know, people on the other nine floors. We thought it very important for people to be aware of each other visually. This is often neglected in work environments, though not, of course, in homes. After all, a working group is a sort of family." Roche's solution was to give each person both private and public space by creating a C-shaped building with glass-walled offices overlooking the interior court. He calls the atrium a "living room."

The Ford building fits neatly into its neighborhood, in part because it is not a skyscraper. The structure's granite-clad concrete, steel and glass exterior conforms to the heights of adjacent buildings and echoes their color. It is bold in scale on the 42nd Street side, and unassuming on 43rd Street, which is more residential.

The Ford commission launched Roche and Dinkeloo as innovators in office-building designs, the most intriguing of which are still under construction. During the boom years of the 1960s the number of projects coming into their office multiplied and some they

The Lehman pavilion at Metropolitan Museum of Art is simple, stark, symmetrical—and elegant.

turned away to prevent the firm from becoming too large. Where other firms became corporate-style businesses, computerizing and systematizing their operations, Roche Dinkeloo maintained a hands-on approach. One of the least publicity-minded of large firms, Roche Dinkeloo has sent out only one press release during its lifetime, an announcement 16 years ago that its name had been changed.

During the late '60s and early '70s, the firm continued experimenting with glass-and-steel greenhouselike structures as well as stone-and-concrete solid forms, often combining the two. Among their clients were the U.S. Postal Service, the Royal Bank of Canada, educational institutions and corporations. They designed a Fiat headquarters (never built) in Turin, Italy; a plant for Cummins Engine Corporation in Columbus, Indiana; a hotel and office building for the United Nations in Manhattan; a master plan for New York's Metropolitan Museum of Art; and several university art centers. Their designs were abstract, geometric, pristine and in marked contrast to the most fashionable buildings of the day.

In 1963 Roche and Dinkeloo had begun design of their Knights of Columbus headquarters building (p. 97) in New Haven, Connecticut. It was the first of several of their designs to be criticized as overly abstract, emotionally remote, scaleless and overscaled. The building does present an astonishing image as one drives into the city on the freeway. It is as though New Haven had built as its gateway a power plant with four heavy corner towers sheathed in purplish-brown silo tile. Roche explains: "I did it as a building on a highway. The large scale was really important there. Where you have small buildings on a highway, they just don't exist, have no excitement, nothing to look at. You have to look at scale in the context of the particular environment."

Among Roche Dinkeloo's several museum projects, the most ambitious and publicized is the vast ensemble of additions to the Metropolitan Museum of Art. It is a collection of garden courts and new structures, whose sleek glass and limestone garb is in deliberate contrast to the Metropolitan's original neoclassic building. The first major addition to be completed was the exquisite Lehman pavilion (above), built to house the Robert Lehman Collection. It is topped by a pyramidal glass roof covering an 82-foot-high court surrounded by re-creations of rooms from the donor's house.

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There is a distinctly surrealistic quality in some of Roche Dinkeloo's work. Most extreme, perhaps, is the complex of three colossal reflective-glass and concrete pyramids on prairie land close by an interstate highway outside of Indianapolis. It is headquarters for the College Life Insurance Company of America (p. 93). The idea was to create "instant identification for the corporation even at 80 miles per hour," says Roche. An architect and friend, who regards Roche's overall accomplishment in design as remarkable, sees this complex as "a giant formalist object, a series of things that look scattered from the sky by some mindless—or mindful—giant from another planet." Inside, the buildings are warm and comfortably scaled, with slanting glass walls and high luminous ceilings.

Most successful of all, perhaps, is Roche Dinkeloo's recent work with corporate offices. Their 1975 addition to the Deere administrative center, which Saarinen designed and Roche and Dinkeloo completed, extends the attempt begun a decade earlier at the Ford Foundation to better the nine-to-five life of office workers. It is an expansion on the idea developed there of combining efficiency and enchantment. The addition is a low-lying, elegantly detailed, weathering-steel and glass building that overlooks a huge, meandering, glass-covered garden.

In predesign stages of his firm's Union Carbide building, nearing completion in Danbury, Connecticut, Roche interviewed company employees at all levels and turned up some interesting facts. Most notably, the company was ensnared in a system that demanded nine different office sizes and a range of furnishings and accouterments. "Here were these mature, honorable people," observes Roche, "being subjected to and administering a kind of kindergarten system at costs that were sapping their finances and energies." He persuaded management to scrap this pyramid of perquisites and give all employees the same size office, roughly 13 feet square.

By designing a long building with prongs growing from the spine ending in snowflakelike appendages, Roche was able to give each employee a room with a view overlooking Danbury's countryside. The plan also does away with landscape-defacing parking lots and long treks from car to office in inclement weather. Spanning the central core of the building are two four-story parking garages. Employees arrive by car, take a ramp to the level on which they work, park, and walk across an enclosed bridge to their nearby offices.

In contrast to Union Carbide, with its low-key image intentionally tucked away to avoid offending suburban sensibilities, Roche's scheme for General Foods Corporation's headquarters in Rye Town, New York, will stand near a highway as a white attention-getter with Italianate and spaceship overtones. Roche's wry comment: "It is the most obvious thing I could have done. It will give employees and the corporation a sense of identity. If it looked like a warehouse, people would say, 'So what.' " When it is completed in 1983, the General Foods building's design will be symmetrical with a Beaux-Arts-style flavor. Raised on a three-story base containing parking, it will have unmistakable references to the past, a sense of whimsy and irony, be symbolic and metaphorical, eclectic, complex and contradictory—all of which are hallmarks of Post-Modernism. Has Roche, then, become Post-Modern?

Roche, as did Saarinen, bristles at such observations based on rabbit rather than elephant time. "I think," he says, "whether we like it or not, responsible architects are all headed in the same direction, because we're all part of the culture and the culture is affecting us all. We're retaining the best instincts of the Modern while, of course, retrieving some aspects of history and searching more for cultural connotations.

"On one level, all architecture is eclectic; the invention consists in assembling the parts which already lie before one on the ground. It was inevitable that there would be a reaction to the Modern movement's narrow vision, because it neglected people's esthetic preferences and intellectual and emotional needs.

"If human needs go beyond function, they also include more than style. The responsibility of an architect is to try to understand what the needs are, not what his own needs of expression are. What we do is create slightly better working conditions, living conditions, despoil nature a little less. Whatever else architecture does, it writes the history of our time."

Shown shortly after completion, Knights of Columbus building dominates freeway approach to New Haven.

MACY S

Is there a future for individual investors in America's stock market?

William Freund and Jude Wanniski voice their opinions

Recently, more individuals have been investing in the stock market, but they've been investing less. What will the future hold? That is the topic of the following Looking Ahead report — another in a series focusing on issues critical to business.

An Optimistic View

Dr. William C. Freund
Senior Vice President
and Chief Economist,
New York Stock Exchange

Is there a future for individual investors in America's stock market? A resounding *yes*.

But success depends in large part on the individual's perception of his relationship to the market. Too often an individual sees the market as an overwhelming or mysterious force run by huge institutions.

This attitude of "market as adversary" overshadows the very real financial and psychological benefits offered by individual involvement in the market.

Why is individual shareownership desirable? It gives each of us our own direct stake in our economic system. It works to diffuse economic power to help keep our competitive system responsive to the majority of the population. It helps unify "owners" and "workers" in the common goal of intensifying productivity growth for the economic good of all.

Boosting productivity

The last point is particularly significant. Currently, this country is in a productivity slump which impairs our ability to compete domestically and in world markets. Recent New York Stock Exchange studies indicate the importance of boosting productivity growth. And one way of accomplishing this is to eliminate the wall which now seems to exist between management and labor. A key to destroying the barrier is individual involvement in the market, for employees can then assume a direct equity interest in the companies they work for as well as American enterprise in general. They, in short, join management through their association in the market. The economy as a whole, as well as the individual investor, will be well served by such a move. The U.S. needs unprecedented amounts of new equity capital to help finance the renewal and modernization of its business plants and equipment. Through increased equity investments, individual investors can help launch a new era of capital formation, rising productivity, and real economic growth. If

that happens, millions of individuals should reap the rewards of investment in stock.

Toward this end, the New York Stock Exchange does everything in its power to assure that the rights of individual investors are at all times protected. For example, on the Exchange, an individual's order to buy or sell at a specific price has the right to participate in even the largest transactions by institutional investors. Through close regulation and surveillance of the marketplace, we do our best to see to it that nobody — individual or institution — trades on the basis of inside information.

Clearly, there is a need for the individual investor in the stock market. And more people are investing in stocks, especially at younger ages. That is a strong vote in favor of the proposition that there *is* a future for individual investors in America's stock market.

Strengthen Dollar First

Jude Wanniski
President, Polyconomics

Over the past decade, the stock market was a downright dangerous place for people to put their savings. A hundred dollars invested in stocks was worth, on average, only $54 nine years later after correcting for inflation. In the decade ahead, the stock market may become a delightful place to be, but only if our government changes its policy toward our American dollar.

The stock market, after all, is by far the best gauge of the health of the national economy. And the entire dollar economy, worldwide, got off the track a little more than ten years ago because of a drastic change in the government's policy toward our currency.

Specifically, President Nixon on August 15, 1971, ended the government guarantee that the dollar would be worth a specific amount of gold. The change was based on the notion that by devaluing our currency, we could buy fewer goods abroad and sell more American goods in the export market, thereby increasing the number of jobs for American workers.

The real effect was to damage the dollar as a standard of value. Its price, in real goods, has fluctuated dramatically, first with the worst inflation in our history, now with one of the most serious deflations. There has been an illusion of expansion, but it has been achieved only by forcing wives out of the home to work and by pulling students away from their books.

A dramatic turnabout

Only when our government restores the dollar's guarantee will we see real economic expansion and a rising standard of living. But when it happens, it will happen dramatically. With faith in the dollar restored, interest rates will fall to low levels and the economy will blossom with the return of long-term credit. The housing and automobile industries, which rely on the availability of credit, would lead the way in a buoyant economy and a buoyant stock market.

And yes, we need to get the *individual* investor back into the market, especially those willing to take the risks in developing new enterprises.

Buying stock is buying a piece of the future. And with the benefit of our hindsight, the future looks potentially bright. There has already been a major shift of attitude against tinkering with the dollar's value. And the government has now seen that the tax system cannot be used to punish productive effort and investment.

Much remains to be done. But when the reduction in tax rates is finally in place, and a sound dollar restored, the stock market will be a comfortable place for the American investor to be.

What Opinion Leaders Think

Reported by
Kenneth Schwartz
Vice President,
Opinion Research Corporation

In the eyes of the nation's opinion leaders, the individual investor's participation in stock market trading will decline or stay the same rather than increase.

The Opinion Research Corporation surveyed 500 opinion leaders in the worlds of business, media, academics, labor, government, and public interest groups to learn their views of the future of individual investors in the stock market. Interviews were conducted on behalf of The LTV Corporation during the month of February 1982.

The general outlook for participation by the individual investor is pessimistic — prediction of decreased participation is especially high among labor leaders (51%), public interest group leaders (46%), and academics (44%). Only business executives seem somewhat optimistic — 39% feel participation will increase, though as many as one in three feel it will do no better than stay the same.

Leaders who think individual trading will decrease were asked why. The prime reason was that other financial vehicles, such as pension, money market, and mutual funds are more attractive than the market to today's more sophisticated investors. Another important reason is general concern over economic conditions, inflation and stock market instability.

Institutional involvement thought positive

Opinion leaders as a group do not seem overly concerned about the growing dominance of stock market trading by institutional investors. Overall, in fact, 37% of those surveyed felt this institutional activity was "good" as opposed to 27% who termed it "bad". The main exception was the group of public interest group leaders: 43% felt institution involvement was a bad trend.

Leaders were asked their views on the effectiveness of recent tax law changes, designed to encourage individual investors. Their opinions were divided.

Those who think further changes in tax laws are needed think the two most significant incentives would be (1) eliminate or revise the capital gains tax and (2) eliminate double taxation of dividends.

How LTV Is Involved

Speaking for LTV,
Paul Thayer
Chairman of the Board
and Chief Executive Officer

The stock market. Is there a future in it for the individual investor? Apparently a great many individual investors think so. Today, one in every seven Americans is a stockholder. And almost half of those shareowners are in families with total annual income of $25,000 or less.

Millions of individuals in this country own stock in the companies for which they work. Through various employee stock purchase plans, they develop a direct financial involvement in the future of their companies and in the growth of our economy in general.

Individual involvement in the market is the very cornerstone of our democratic enterprise system. But is there a future in it for people who want to buy a stake in that system? There is if that system and the nation behind it are as strong as I believe them to be.

The stock market is an important economic barometer. A recovery in the market usually is the forerunner of recovery from a recession. Of equal importance, the stock market is a barometer of the national mood, reflecting the level of confidence people feel in the country.

At the moment, the nation is in evident economic turmoil. The stock market is reflecting this and participation by individual investors has correspondingly waned. In the short term, this is an understandable adjustment to present realities. For the long term, I believe that we can solve our problems — and emerge from the present turmoil stronger than ever.

This country has enormous resilience, a strong collective will and a demonstrated history of overcoming adversity. I believe we will become increasingly competitive internationally, more productive, and able to meet the difficult challenges that face us. I also believe that government, labor, and business will have to work in closer harmony than in the past to make this possible.

Given this latter development, we can look forward to a vibrant economy and to a stock market that will offer a promising future for the prudent, informed individual investor.

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LTV

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By Ruth Mehrtens Galvin

Control of dreams may be possible for a resolute few

Lucid dreaming is rare, and difficult to achieve, but proponents believe it may provide insight into how our brains function awake and asleep

At the onset of a nightmare, a dreamer perceives herself in eerie surroundings, alone and threatened.

It was November 1914. Mary Arnold-Forster had volunteered to carry a message from the British War Office to army headquarters in Belgium. She planned to fly. Waiting in the anteroom in Whitehall, she noticed the walls were hung with portraits that were crooked, but too high to reach. She flew up and was just about to straighten the second Earl Grey when the nail came loose and his picture fell into her hand.

"At that moment the door opened and an official came in," she recalled later. "I descended and began to apologize and explain, but he smiled and said it did not signify." She should take the portrait with her, he insisted, as a sort of confidential passport, since those in the know would remember that the earl was related to Sir Edward Grey, the Secretary of State. Somewhat annoyed by so bulky a bundle, Mrs. Arnold-Forster flew off to deliver her message to Winston Churchill, whom she found "in supreme command."

Mary Arnold-Forster was dreaming again. She often flew in her dreams. She was what is now known as a "lucid dreamer": able to recognize, during a dream, that she was dreaming. She could then control the plot. (When she began to lose power on the way to Belgium she simply slipped unnoticed into a house, ran up the stairs and took off again.) As a child, Mary Arnold-Forster had learned to end bad dreams by flying away from what frightened her. She also discovered that she did not have to wake up, but could go on dreaming of more tranquil subjects.

By little leaps and bounds she taught herself to fly up as well as down stairs, to fly through the long rooms of the British Museum and other large galleries or, in a long gown that hid her ankles, to glide along Oxford Street just above the ground. Most people took no notice. If they commented, she merely explained that gravity did not apply to her, and gave them lessons.

During World War I when, like many a wife and mother, she had recurrent dreams of a disastrous telegram from the front, she reminded herself that she was dreaming.

Mary Arnold-Forster kept careful notes of her dreams for years, and wrote a delightful book about

them, *Studies in Dreams*, published in 1921. While not venturing to question the new Freudian wisdom about pathological dreaming, she was unconvinced that psychoanalysis had come up with the last word about the dreams of normal people. "The fact is," she wrote, "there are dreams and dreams, and we must get rid of the assumption that each dream resembles all the others." The peripatetic Harvard psychologist and physician Dr. Morton Prince agreed with her sufficiently to write the foreword of her book.

From Aristotle to Freud, observers of human nature have noted that people sometimes recognize when they are dreaming. Dr. Prince called it "double consciousness." Dr. Stephen LaBerge, a researcher at the Stanford Sleep Laboratory, refers to it as being "fully there: awake in the middle of the dream world."

Terror or surprise can catapult any of us into the thought "I must be dreaming." It may be a dream too frightening to believe. It may be something as amusing as the night LaBerge took out his contact lens and saw it multiplying into many lenses all over the floor. If you have had the same dream before, the memory of it may make you realize that once again you are in a dream. Still, the chances of having a lucid dream spontaneously are about as good as finding money in the street. Most of us seldom realize we are dreaming, but accept all that is happening to us as reality.

It is the very essence of dreams that they are usually what psychologist Allan Rechtschaffen calls "single-minded." That is, in our dreams there is no second self to monitor what is going on, as when we are awake. If we could learn what function of the brain causes this single-mindedness, we might even discover the opposite: what it is that makes human beings conscious of self when awake—the great presumed difference between us and other animals.

Robert Louis Stevenson and the brownies

Countless examples exist of scientists who made great breakthroughs during dreams and awoke with the solution to their problems. Dream books invariably tell the tale of Robert Louis Stevenson, who said he merely wrote down in the morning the stories dream "brownies" told him at night.

We usually forget our dreams as soon as we awaken. Even as we attempt to write down the details, they slip away. People who keep dream diaries, though, can cultivate the art of dream recall.

Probably no one spent more time recording his dreams than a 19th-century French aristocrat, Baron d' Hervey, the Marquis de Saint-Denys. Born in 1822 and educated at home, he began writing down every dream he could remember, when he was only 13 or 14. By 1841 he had filled 22 volumes. During the first month and a half of his journal, he recalled only fragments of dreams. In six months, he not only remembered dreams every night, but in about a third of them also recognized that he was dreaming and consciously directed what happened. Hervey de Saint-Denys had become a lucid dreamer.

He went on to become a noted specialist on China, a professor at the Collège de France and a chevalier of the Legion of Honor. He continued to keep his dream journal and in 1867 published *Dreams and the Means of Directing Them*, postulating that the mind always had volitional ability which could be used in dream-

Photographs by Peter Angelo Simon

As the irrational dream progresses, she is terrified, and poised to run from grasp of hands besetting her.

ing. He told how he got rid of demons, solved chess problems and successfully directed himself to dream the same dream again when details escaped him.

Lucid dreaming is by and large a learned skill, until recently mainly the province of talented amateurs like Mary Arnold-Forster and the Marquis de Saint-Denys. Such unverified personal reports are not science, however. It is all too easy to deceive ourselves, and the good scientist always suspects himself first. Says Allan Rechtschaffen, the generous and meticulous man who runs the University of Chicago's sleep laboratory, "Beware the anecdote!"

In 1974, at the meeting of the Association for the Psychophysiological Study of Sleep (APSS), psychologist Patricia Garfield offered evidence that by "self-conditioning"—intense interest in dreams and advance planning—we can determine what we are going to dream about and have long lucid dreams. A tall, handsome Californian, Patricia Garfield, like Hervey de Saint-Denys, began a dream journal at the age of 14. She, too, has filled 22 volumes. Now 47, she insists we can all have lucid dreams and do anything we want in them. Her claims meet much resistance. At the University of Wyoming, psychologist David Foulkes has found that even those students intensely interested in changing their dreams have seldom succeeded.

Is it really possible to rid yourself of your own bad dreams—nightmares? Yes, says Rosalind Cartwright, director of the Sleep Disorder Service and Research Center at Rush-Presbyterian St. Luke's Medical Center in Chicago. Several years ago, Dr. Cartwright taught patients subject to recurrent bad dreams to press a buzzer when they began the dream. Awakened, they recounted it. The patient and her psychotherapist then planned how best to change the dream. When the patient slept again in the lab, she would signal the start of the nightmare, the technician would buzz back as a reminder to change the dream, and the patient would successfully do so. One woman, who had dreamed repeatedly of being sucked under by huge waves, realized during therapy that she should be able to swim as well in dreams as in reality and taught herself to dive under the dream waves. She never again had the dream.

The physical characteristics of dreaming sleep have only begun to be understood in the past 50 years. It was first observed during the 1930s that sleep has several stages, each with its peculiar type of brain activity. In 1953 researchers Eugene Aserinsky and Nathaniel Kleitman discovered that during one of these stages, which occur roughly every 90 minutes, rapid eye movements can be recorded. Most dreaming occurs during this rapid-eye-movement, or REM, sleep.

REM sleep is a time when our large muscles are completely paralyzed. We cannot walk or talk. At the same time, most of our brain cells are vigorously active. Among them are the cells in our motor centers, a phenomenon that may explain sensations of movement, such as the ability to fly, in dreams. Nerve cells which govern motivation and memory, however, turn off during REM; consequently most dreams are involuntary and amnesic.

Eyes left . . . eyes right . . . signal flight

Last summer psychologist Keith M. T. Hearne sent to the annual meeting of the APSS in Hyannis, Massachusetts, a report that he had used the eye movements of REM sleep to record lucid dreaming at the University of Hull, in North Humberside, England. Attached by electrodes to a polygraph that recorded his brain waves and eye movements, a lucid dreamer was instructed to give a number of left-right eye movements when he recognized he was dreaming.

Later, Hearne taught the dreamer to signal during specific activities, such as flying, and also to act on instructions given before he went to sleep. The sleeper's account of his dreams on awakening matched closely the eye movements on the polygraph recording.

Quite independently, at the Stanford University

When not traveling here and abroad as the senior behavioral-studies correspondent for Time, *the author lives in Boston and Martha's Vineyard.*

Medical School Sleep Laboratory (SMITHSONIAN, November 1978), a young American was also at work on lucid dreams. Twenty years ago, as a child, Stephen LaBerge had lucid dreams. He could call back the pirates of his dreams to continue his adventures, night after night. He got rid of his frightening dreams of drowning by recognizing that he was actually "breathing" under water.

When he came to work on his doctoral degree at Stanford, LaBerge was inspired to try to revive his own lucid dreaming for scientific purposes. He developed a method he calls MILD—mnemonic induction of lucid dreams. Waking from a dream, he first memorized it, then spent ten or 15 minutes reading or doing something else that required full wakefulness. As he tried to go back to sleep, he would tell himself: "Next time I'm dreaming, I want to recognize I'm dreaming." Through MILD, LaBerge found he could stimulate lucid dreams as often as he chose.

LaBerge then went to sleep in the Stanford Sleep Laboratory, attached by electrodes to a polygraph that would record his brain waves and eye movements, as well as any pressure he might apply to a switch he attached to his wrist. When he recognized he was dreaming, LaBerge made a prearranged number of extreme left-right eye movements, as if he were trying to look at his ears. He dreamed that he was clenching his fist. Although he could not move in reality, he succeeded in twitching his muscles just enough to record the Morse code for his own initials on the polygraph.

Lucid dreamer, fully aware of being in her dream, can confront and vanquish the hands of terror.

'Row, row, row your boat . . .'

In subsequent laboratory tests on himself and six other subjects trained in the MILD method, LaBerge did more elaborate dream experiments—suggesting that subjects try to breathe rapidly, sing, or count while dreaming. A thermistor attached to the sleeper's nostrils recorded the breathing. Electrodes attached to the head indicated more activity in the right hemisphere of the brain during singing (the song was, naturally, "Row, row, row your boat . . . life is but a dream") and more activity in the left hemisphere during counting—just as when we sing or count, awake. With left-handed dreamers, the results were reversed.

Having shown an exact match between his polygraph record and the left-right signals of the dreamer's eyes, rapid breathing and efforts at muscle activity, LaBerge reasoned that we should be able to show other correlations. Shouldn't our throats move when we try to sing or shout in a dream? Shouldn't our ear muscles move when we "hear" the song? He has embarked on experiments to test these things, too.

At the Veterans Administration Hospital in Palo Alto, California, doctors have successfully used an ear mold wired to a polygraph to record reaction to the voices schizophrenics hear during their hallucinations. Stephen LaBerge thought the device might be useful in his research. He arranged for Beverly Kedzierski, a 28-year-old PhD candidate at Stanford who has had lucid dreams all her life and is now skillful at directing them, to sleep in the hospital's laboratory to try the ear mold on lucid dreaming. She also wore electrodes at her throat, eyes, chin and on the top of her head, a thermistor at her nostrils, and a small gauge to indicate when she moved. Just before going to sleep she rehearsed several tasks she planned to superimpose on her longest dream—which usually comes in the morning, shortly before awakening from a full night's sleep.

As 9 A.M. was approaching, the polygraph began to show the relaxed but twitching muscle tone and characteristic sawtooth brain waves of REM sleep. Suddenly, the polygraph needle shot up, then down, in wild activity. Beverly had signaled a lucid dream.

Beverly reported later that she dreamed she was in a sleep laboratory. She flew out into the next room, which, in the dream, became a huge Olympic swim arena. Flying around, Beverly gave the strong left-right eye movements that showed she knew she was in a dream. Then she dreamed she held her nose and breathed hard—her first assignment. She signaled again with her eyes. She was about to start the second assignment: clapping her hands in the dream.

But Beverly found she was wearing an inflated vest

Having laid to rest her hobgoblins, she is free to shift her dream to more pleasant subjects.

like the ones scuba divers use to equalize air pressure. She could not bring her hands together across it. She banged as hard as she could on the sides of the vest, hoping to make enough noise to move her ear muscles. She signaled again with her eyes and then—as planned—started to shout the numbers one to five. Hearing a noise outside her dream, she realized she was waking up, gave a double batch of eye signals to so indicate and, awake, wrote down her dream.

Beverly's EEG showed dreaming sleep. The needles had also faithfully recorded her extreme eye signals. Her shouts showed as faint muscle twitches. The ear mold, alas, did not show the contractions that should have happened when she breathed with her nose held, or clapped or shouted. The diver's vest had demonstrated, too, how a dream can get away from even the most experienced of lucid dreamers.

Like Keith Hearne in England, Stephen LaBerge and his colleagues believe he has proved that lucid dreaming is a bona fide experience of sleep, not waking. Both Hearne and LaBerge seem also to have confirmed something that has eluded sleep researchers for years: proof of the common-sense notion that our eyes move during dreaming in exact correlation with our dream—that we are actually looking at what we are dreaming. This so-called "scanning hypothesis," which LaBerge's Stanford professor William Dement and his colleague Howard Roffwarg thought they had documented 20 years ago, is still controversial.

The lucid-dreaming lab work could be seen as offering evidence for the long-held but unproved theory that one reason for REM sleep may be rehearsal of waking activity. Dream research contradicts the common notion that elaborate dreams can take place in an instant. Counting to five during a lucid dream takes precisely as long as counting to five awake.

A garbage man in outer space

The Hearne and LaBerge work complements that of two Harvard neurophysiologists, Allan Hobson and Robert McCarley, who have been seeking for several years to show that dreams incorporate the vigorous orders for physical activity sent out by the base of the brain during REM sleep, and that the bizarre behavior in dreams reflects sudden shifts within the brain. Last year, Dr. McCarley studied 104 dreams recalled after REM-sleep awakenings. He found strange events and action galore: people floating and flying, attending three-ring circuses, hockey games, parades. There was even an outer-space garbage man ("I remember distinctly all the computer-clicking and light-flashings . . . a giant garbage scow . . . carrying several million tons of garbage to be shot into the universe . . . a regular route").

In her lucid dream, she now feels she is flying. Such movement sensation may be due to the fact that most brain cells, including those governing our motor centers, remain very active during dreaming sleep.

But of Dr. McCarley's 104 dreams only one could be described as lucid. According to his and Hobson's theory, dream lucidity should be rare because of the fundamentally automatic and involuntary nature of REM sleep, but it should not be impossible because insight and volition, rather than being completely inhibited, are merely held in abeyance.

While doing research at the National Institutes of Health 20 years ago, and having heard of Mary Arnold-Forster, Dr. Hobson successfully taught himself to dream lucidly and to fly in his dreams. He recalls some hard running and arm flapping, then rising higher and higher until, one night, he flew above a friend's Maryland farm. "I could see all of my friends in the front yard of the house, looking up with pleasure and amazement, waving their arms at me, as I circled and circled, free as a bird, above the house," Dr. Hobson reports. Landing was nowhere near as difficult as learning to take off: "One simply glided back down to a smooth landing."

Hobson verifies that lucid dreaming is both great fun and that it is very difficult to learn. "You're pushing REM sleep as close to waking as possible. The involuntary nature keeps trying to take over. It takes an effort of will working against overwhelming odds."

Interested in having some lucid dreams myself, I began keeping a dream diary and going to sleep saying: "Tonight, I will have a lucid dream." For four nights, I had neither a lucid dream nor any dream I could remember. On the fifth night I woke at 5 A.M. and tried the LaBerge MILD method. I read a magazine article about Ireland, then, turning out the lights, repeated over and over that I wanted to have a lucid dream and willed myself to dream of Ireland.

I dreamed I was driving along a very Irish seaside road among rolling green hills and ancient trees. I seemed also to be somewhere in the air above myself, and noticed that at the crest of a hill ahead the road branched off to the left, down toward the ocean. "Beautiful," I thought, "I'll drive that way." But as I reached the spot the seaward branch disappeared and the road continued straight ahead toward a tree whose roots had washed away, making a deep gully into which the car was sure to fall. "You are *in* this dream," I told myself. "You can make the road do anything you want it to." Immediately, I began to wake up, and try as I might to drift back into the dream I could not. It was my first—and last—lucid dream.

The difficult art of lucid dreaming

Psychologist Jayne Gackenbach has found that lucid dreams are no different from other memorable dreams except for the fact that you know you are dreaming and have some measure of control. How can you use that control? Like Mary Arnold-Forster, modern lucid dreamers first use it to end their nightmares. They get rid of the bad guys in their dreams by asking them what they want. It follows, they say, that you can get to know things about yourself that disturb you, which turn up in your dreams as thugs, monsters and all kinds of evil characters.

Dream psychologist Gayle Delaney disagrees. A gold-medal skater and summa cum laude graduate of Princeton, Dr. Delaney, 33, switched from Russian studies to psychology after her own experiences with lucid dreams. She teaches people to dream about their problems, but strongly doubts that we can change our lives simply by changing our dreams. The man who kicks away a dog in his dream one night is likely to find the same dog around the corner waiting to bite him the next night, she contends, unless he learns while awake what is bothering him. "Sometimes it's better that the dream end badly than to change it by being lucid," she cautions. "If you awake frightened, you are more motivated to go and get help to understand what is threatening you, and then take the leap of courage to change your life."

Are there any traits that distinguish people who dream lucidly? In research at the University of Virginia and the University of Northern Iowa, there are indications that such people may be more adventurous than the rest of us—interested in things like scuba diving, rock climbing, free falls in space. At Iowa, Jayne Gackenbach also finds some curious sex differences: the women are apt to be take-charge people who know where they are going; male lucid dreamers are more likely to be beset with personal problems.

Advocates of lucid dreaming insist that the ability to have lucid dreams is latent in us all. Stephen LaBerge compares it to language. Rosalind Cartwright suggests it is like learning to read. And it is an exercise in memory. The more dreams you can remember, the more likely you are to have lucid ones. You need intense interest in your dreams, the ability to recall them regularly, the willingness to set yourself the goal of lucid dreaming night after night until it happens. You need plenty of sleep and lots of practice.

Sexual dreams are rare; nevertheless, Patricia Garfield thinks lucid dreaming enhances them. Stephen LaBerge believes that whether you have erotic experiences in lucid dreams is largely up to you: "As the dreamer, so the dream."

There is much talk about possible therapeutic applications for lucid dreaming: as a substitute for behavior therapy or hypnosis, in learning to stop smoking or to end one's fear of snakes, or in psychosomatic illnesses such as asthma. Serious scientists warn that psychology can be a graveyard of premature claims. It remains to be demonstrated that there is a reliable method for teaching large numbers of people how to achieve lucidity and maintain it long enough to control their dreams.

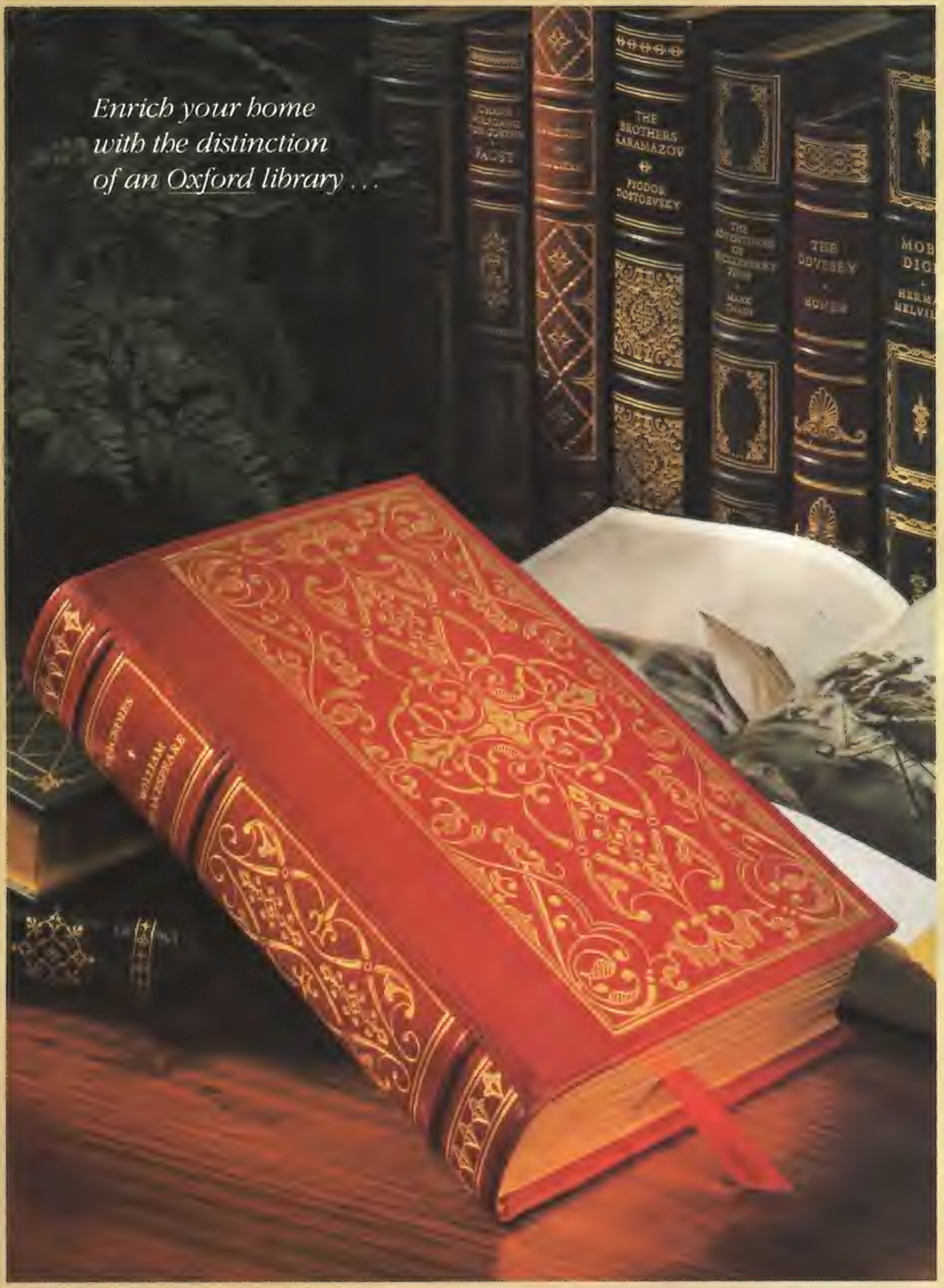
Further laboratory work with lucid dreamers could help solve the persistent problem of how long it takes to have the elaborate and confusing experiences dreamers often report when awakened. If the lucid dreamer could signal the beginning of a dream and the end of it (and later recall having made those signals) we would at least have time-markers for the beginning and end of the dream story. Lucid dreamers could also be used in continued research on the correlation between dreams and eye movements and so finally verify or contradict the "scanning hypothesis."

A definitive answer to the question, "What is the difference between natural lucid dreamers like Beverly Kedzierski and the rest of us?" might tell us something not only about consciousness of self and memory, but about our extent—or lack—of reflective thought when we are awake.

Still, the world of scientific dream research is small. Within it, probably no more than two dozen people are working on all aspects of lucid dreaming. Until they learn more, it remains as true today as when Mary Arnold-Forster wrote 60 years ago: "There is room in this fascinating study not only for the philosopher and the psychologist, but also for the unlearned but faithful recorder of personal experience."

In the morning she entered dream in journal. Lucid dreaming takes discipline, persistence, determination.

DREAM JOURNAL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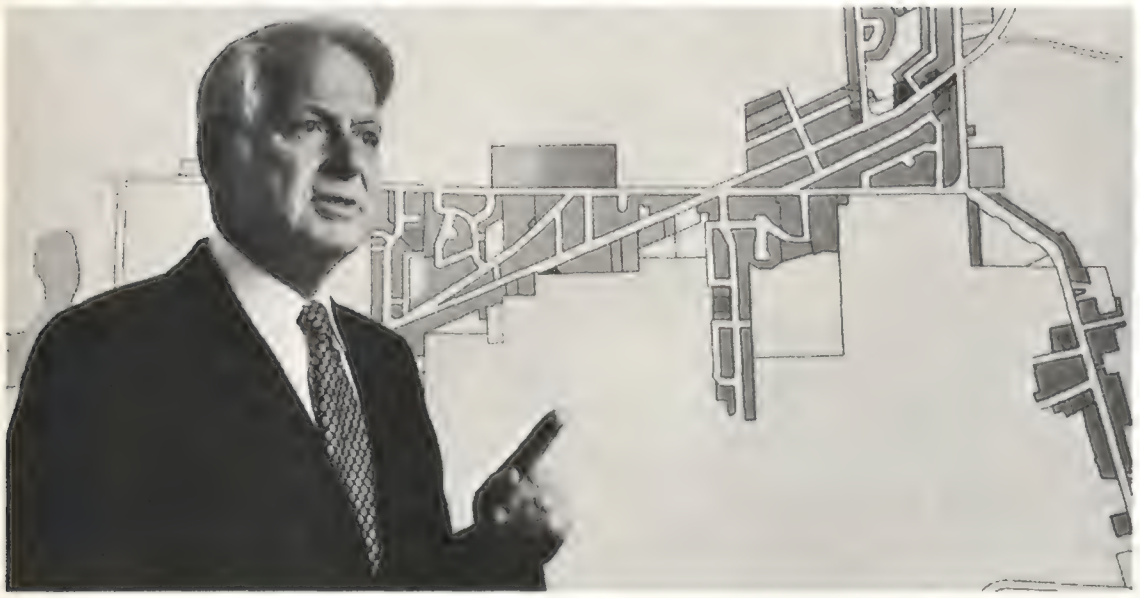
A message from one of the nation's leading authorities on industrial development . . .

INDUSTRY MUST HAVE DEPENDABLE ELECTRICITY

By Maurice Fulton

Chairman of the Board, The Fantus Company



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In the search for suitable industrial locations, the availability and reliability of electric power possibly is becoming the single most critical factor considered.

Other essential requisites — labor and transportation — can be attracted to a particular site if necessary. But power must exist — in sufficient, dependable supply — before we even begin evaluation of all the other characteristics of a community that may or may not make it an appropriate environment for industrial expansion or new development.

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More and more, factories depend on computers, precision electronic tools and automated machinery. Interruptions or reductions in electricity supply are disruptive and expensive.

Adequate Supplies Critical

Therefore, we cannot risk siting a plant where power supplies are at all questionable. And we must be assured of adequate supplies well into the future.

A new plant or a major expansion represents a substantial long term investment. Our clients must be confident that necessary resources will be available for the life of the facility.

Utilities Need Capital

The ability of America's electric utilities to make the investments necessary today to assure adequate supplies tomorrow is critical to the industrial revitalization of the country. New generating facilities can require ten years or more to be brought on stream. In the meantime, existing facilities are becoming out of date and increasingly expensive to operate.

But utilities cannot invest in new generation, transmission and distribution facilities — or even adequately maintain existing facilities — if they cannot attract investment capital. To do that, they must be permitted to earn sufficient amounts to assure their financial health and provide returns competitive with other potential investments. In many cases, shortsighted regulatory policies are sapping the financial strength of utilities so that they are having difficulty raising capital at reasonable cost.

Consequently, programs for new capacity, conversion to cheaper, dependable fuel supplies and replacement of obsolete facilities have been postponed or abandoned.

The inevitable result will be less reliable service, probably at higher-than-necessary rates, which industry cannot tolerate for long.

DOE Warns of Power Shortfall

A report issued recently by the U.S. Department of Energy warns:

". . . continued utility financial problems, against a background of modest demand growth, may cause a long-term shortfall in electricity supply. If powerplants continue to be cancelled and deferred as they have been recently, supply sufficiency could be at risk in much of the country as early as 1990."

From the point of view of industrial development, the electricity supply problem may be closer at hand than the next decade.

With alarming frequency, utilities are telling us that they cannot economically handle the increased demand a major industrial development represents today, much less provide assurance of adequate supplies into the 21st century.

The eventual cost to the communities served by these utilities — in lost employment, erosion of tax base, stagnant economic activity — will far outweigh the cost of restoring America's electricity system to financial health.

Maurice Fulton

This is one of a series of messages sponsored by the Edison Electric Institute, representing the investor-owned utilities that deliver 77% of the nation's electricity.

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After a hard day's work on the road, the pipe-puffing itinerant craftsman relaxes in his cluttered truck.

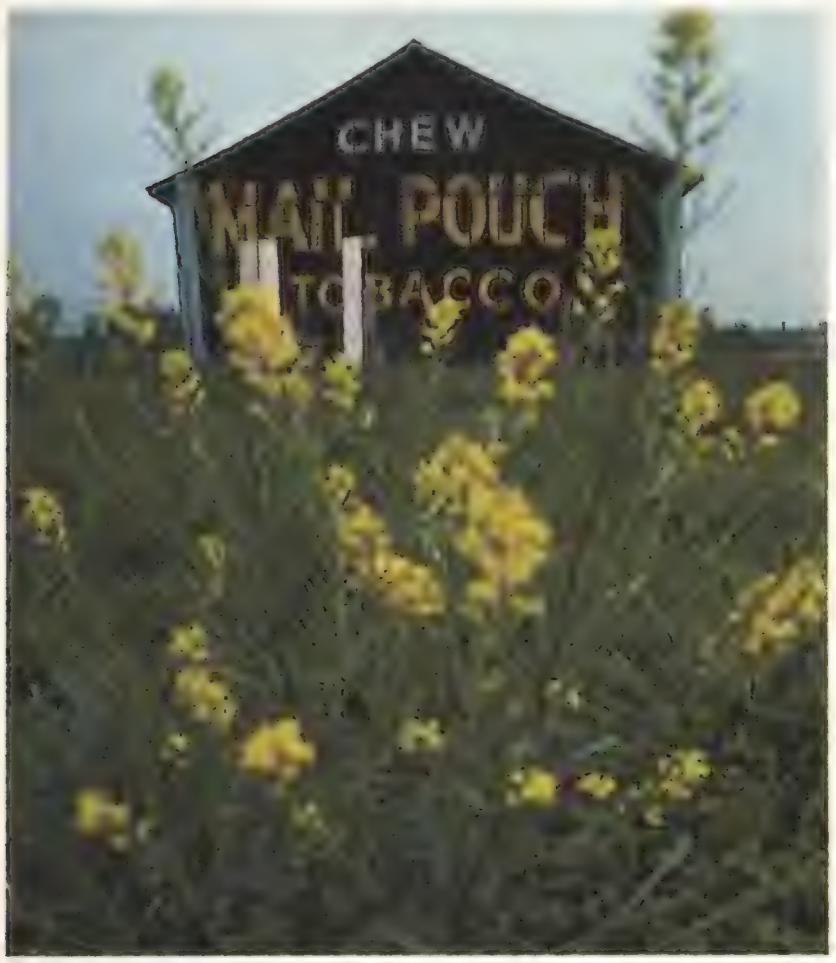
By Jack Fincher

His paintings are national treasures —sort of, anyway

Federal legislation saved Harley Warrick's alfresco works of art; they have given millions of highway travelers something to chew on

Photographs by Dan Carraco

A Harley Warrick retrospective



Still life with flowers near Versailles, Indiana

Landscape outside Macon, Ohio

Painting needing restoration near Florence, Indiana

When a crew arrived in Wheeling, West Virginia, recently to film a TV commercial on Mail Pouch chewing tobacco, the company's Effie Roberts had a suggestion. The script called for an actor to play Harley Warrick, who for 35 years has been painting the Mail Pouch sign on the sides of America's barns. "Why not talk to Harley first?" asked Effie.

"I know what you're thinking and you're crazy," a colleague told her after the crew left to meet Warrick at one of his favorite barns just across the Ohio border. "Harley *can't* play himself on TV!"

"For heaven's sake, why not?" countered Effie. "Harley's been playing Harley all his life. Who in the world could do it better?"

Who, indeed? Maybe Will Rogers could have, or James Whitmore might, but none could be expected to execute a brisk series of blue, white, yellow and black straight lines and ellipses, each several feet long and all perfectly arrayed, with a four-inch bristle brush *freehand*.

Harley Warrick, 56, of Belmont, Ohio, is an authentic American original, all right: as much a study in Norman Rockwell nostalgia as the signs he paints, and a man who can stand in front of his handiwork, look a television camera in the eye as Harley did, and declare with gravelly conviction: "When you've got a good thing going, stick with it." He and Mail Pouch have stuck—unlike the long-gone Burma Shave signs, Coca-Cola trays and Log Cabin syrup cans, three once-ubiquitous contemporaries that succumbed to changing Madison Avenue styles and Main Street fashions. Indeed, along with the Campbell Soup label, the fruit of their enduring partnership has helped to elevate product identification to a fine-art form.

All of which leaves Warrick almost at a loss for words, which he slaps around about as prodigally as he does his customary background mixture of lampblack and linseed oil. How is anybody to assess what turns a 1½-cent-a-square-foot journeyman dauber into a rustic national treasure? Who can say why a rude if exhaustively honed talent (Harley estimates he has painted or repainted the sign on more than 17,000 barns) proves equally in demand across the shrinking rural landscape of the American Midwest; or at the 1971 Smithsonian exhibit at Montreal's exposition; or the State Museum of the Department of Culture and History in Charleston, West Virginia; or the 1981 Ohio State Crafts Fair? Harley can't. He scratches his grizzled head, thoroughly mystified. "I'm just doing what I've always done."

Harley Warrick found his lifelong occupation, or rather it found him, a few days after he was dis-

Pastoral scene north of Madison, Indiana

A recent work near Russellville, Ohio

Composition with disc harrow in an Indiana field

charged from the Army in 1946, at the end of World War II. Mail Pouch painters came to paint the barn on his family's farm. There was an opening on one of their four two-man teams, they told him afterward as they cleaned their brushes. Twenty-eight dollars a week base salary plus those enticing square-foot production incentives, which could boost his take-home pay to $32 if he were industrious. And not to forget the bonus—a chance for a young single man to stay in hotels at company expense and see by panel truck a nine-state area of the nation's heartland.

Still in uniform, Harley signed on. Climbing into coveralls at a nearby barn, he left his Eisenhower jacket hanging on a farmer's manure fork, a comment on a dogface military career in which he had come through the Battle of the Bulge and a rain of shrapnel from his own antiaircraft artillery without a scratch, and with nothing much else to show for it but souvenirs such as a Wehrmacht machine pistol (since sold).

"You were knocking out some two, three barns a day, six days a week," he recalls. "For the first 20 years I worked 50 weeks a year at that pace. That's doing about 700 barns a year, coating or recoating. Sometimes," he goes on, "you had somebody who went on out ahead, leasing them, getting them ready. But not always. A farmer was suspicious of space salesmen. Anybody with a big car, a suit on, a briefcase, meant banks or government, and that was like waving a red bandanna in front of a bull. Most space salesmen didn't tell a farmer what he wanted the barn for. But if you went in like I did and started talking hogs, crops and cattle, then got around to what he knew all the time you was there for, he'd sign a lease for a few bucks or just the new paint job."

In short order, Harley learned instant dead reckoning for horizontal and vertical axes; to fix by eye the center of a barn wall; to cluster the appropriate letters in each line on, above, or to either side of it, then string the words swiftly left and right as needed.

And never mind the weather, he found. But wind, Harley says, is worse than heat or cold. "With billboards, anyway. They give about three feet at the top. You're holding your loaded brush way out here"—he demonstrates with callous, split-nailed hands—"the board's there, see. And then she comes—jam! right into it. Blew a steel panel out at me one time. Thirty-four pounds of steel came flying right past. Lightning's bad, too, especially in flat country. Around Columbus I don't think there's a board hasn't got a split post

The author, who lives in Oregon, wrote about the Golden Gate Bridge in the July SMITHSONIAN.

from being hit. You see an electric storm coming, you get off there, right quick."

Not that it was all unremitting labor amid the ever-hostile elements, Harley hastens to add. Like the time his crew miscalculated, ran out of space, then went on painting the rest of the words around the corner of the barn and onto the other side. "Coming down the road one way you could read it," he muses, all innocence, "but coming the other way you couldn't. We did two or three signs in town the same way."

In 1965 Congress passed Lady Bird Johnson's Highway Beautification Act and probably changed Harley's life forever. By prohibiting commercial signs within 660 feet of the interstate-highway system and other primary highways, the new law was designed to banish billboard "eye pollution." But it darn near sank the Mail Pouch barn tradition. After all, the Federal government argued, weren't those signs, for all their rich, bucolic history, advertising? Not only were new ones forbidden, but the company had to lobby just to save those that existed. Led by Senator Jennings Randolph of West Virginia, however, Congress underwent a change of heart in 1974 and amended the law to exclude landmark signs "on farm structures or natural surfaces," or of historic or artistic significance.

"While a major objective of the highway beautification program is the control of outdoor advertising," noted the Senate Committee on Public Works, "there are some types of outdoor advertising of a unique character that justify preservation"—meaning Mail Pouch. Harley Warrick had become an institution.

When not on the road ("Billboard outfits are always after me; otherwise they get these drunks who don't do the job and lose their paints and ladders"), he lives with his wife, Louise, in a house he built from the ground up during the off-season. They have a 14-year-old son, who loves to draw sports figures, and an older daughter who is a medical illustrator in Houston.

During the winter months, at $25 a crack, Harley does a thriving business right in his garage, painting miniature Mail Pouch ensigns on homemade birdhouses and mailboxes of simulated barn design. He has also been known to re-create the company logo on the walls of dens, restaurants and bars for a fee, not to mention one on the hide of a circus elephant. "I did it in watercolors," he says. "The elephant lay down flat as you please when I started. Then it raised up to its knees as we went along." He laughs at the thought. "It was a little rough to paint on, sort of like burlap. It made me feel kind of foolish."

Still, Harley struggled through because he is nothing if not a thoroughgoing professional. As he says, "My name's on the dang thing. And a man's name has got to stand for something."

Artist at work: Warrick repaints his sign on a tobacco barn east of Georgetown, Ohio.

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By Gina Kolata

When criminals turn to computers, is anything safe?

Wayward programmers, executives, even kids, are breaking the law by 'data diddling,' 'superzapping' or planting 'logic bombs'

In Los Angeles there is a group of teen-age boys who get together socially to talk about their major interest in life—computers. Sometimes they speculate about what it might be fun to do. One boy suggests "breaking into" the financial-market computers—an electronic break-in, not a physical one—and manipulating the Dow-Jones average. Another proposes putting one of their teachers' names on the FBI's "Most Wanted" list. A third says it might be amusing to try to bring down a communications satellite.

What these teen-agers are proposing is not so preposterous as it might sound. "Technically, these kids understand the theory. They could cause damage, although it's not clear if they could do all they say," says Robin Brown, a Los Angeles FBI agent with special expertise in computer crime. Brown cautions that computer systems tend to be extremely vulnerable and that teen-agers like those in the Los Angeles gang are bright kids, out to impress each other with what they can do. Some of their pranks are far from innocuous, he adds. "They have a keen interest in the strategic systems of the U.S. military—and in trying to break into the computer systems that support them."

Officials at the FBI and managers of many corporations and institutions are increasingly concerned about the growth of computer crime. Offenders are both young and old. Because the computer revolution itself is so young, teen-agers are the first generation to grow up with access to small computers. With so many youngsters excited about the technology, it is no surprise that, for some, their interest gets out of bounds. Many teen-agers who are fascinated by computers consider it a challenge to try to break into computer systems by telephone. They are not alone. Within large corporations and institutions, employees, disgruntled ex-employees or clever outsiders pull off heists that, more often than not, are never reported. Those that are reported often go unprosecuted.

Experts in the field do not agree on how prevalent the problem is, or even on how to define "computer crime." Some regard it as any crime involving a computer in any way, which could mean the theft or physical destruction of a computer itself. Others, more narrowly, consider computer crimes to be only those committed with the aid of a computer. Embezzlement of funds may be the most frequent form of such crime, but there are many others, including theft, copying or destruction of important data; invasion of privacy; and "theft of services" (such as an employee using the company's computer resources for his own small business on the side). Estimates of yearly losses range from $300 million to $5 billion.

One reason for this electronic crime wave is the incredible growth over the past five years in the number of microcomputers—and in the number of people who know how to use them. With more than 500,000 home computers in this country, many people now can sit at their own desks and, with a phone hookup, dial into computer networks of all kinds. When big computer systems were designed, this horde of potential invaders was not foreseen.

The high cost of bad publicity

The greatest problem in keeping track of computer crime is that so little of it is reported. William A. Bayse, the Assistant Director for Technical Services of the FBI, points out, "There is a lot of reluctance to report crimes because the resulting bad publicity may cost a company more than the loss itself." Robert Courtney, a New York-based computer-crime consultant, explains, "No one wants to amplify his losses. Shareholders, voters and policyholders all look on major fraud as evidence of gross mismanagement, and usually they are right. If a company decides to prosecute, the crime gets into the newspapers. This means that the bigger the crime, the lower the probability that it will be prosecuted." The result, says Jay Bloombecker, a lawyer who runs the National Center for Computer Crime Data in Los Angeles, is that "we

Computer criminals are hard to detect partly because they leave few traces, no blood, no broken windows.

'Computers are marvelous. You can talk them into spilling their guts and steal forever'

don't know anything about the extent of the problem. And the people who know the most aren't talking."

And yet, as Robin Brown says, "the technology is here whether we want to recognize it or not, and we can't bury our heads in the sand. By publicizing these problems, we help people understand what's involved so they can minimize their losses. It's important for the public to be aware of anything that affects their lives, and the impact of these crimes will eventually hit the consumer."

Most of the experts interviewed for this article stated flatly that it is easy to commit computer crimes. A typical comment came from Ken Thompson, of Bell Laboratories in New Jersey: "Computers are marvelous. You can talk a computer into spilling its guts to you. You can steal forever and the person you steal from won't even know anything is missing."

There even is a new kind of slang to describe computer-crime methods. For example, crimes can be committed by "data-diddling"—altering the data that are entered into a computer. Or they might involve the placement of a "Trojan Horse" in the computer program, meaning that a secret instruction is put into the program that causes it to do something illicit, such as copying confidential files for the computer criminal. Trespassers might enter a computer by "superzapping"—a way of bypassing all the controls limiting access to information in the computer. Another method is to use a "logic bomb," which is a computer instruction that goes off at a specific time. For example, at one firm an unhappy employee inserted a logic bomb to go off on April Fools' Day. The bomb consisted of instructions to destroy the company's files.

The author wrote on cancer therapy for SMITHSONIAN *in August 1980.*

At the Department of Defense, where there is particular concern about computer security, officials have long been aware of the ease with which computer crimes can be committed. In the early 1970s they used to test the vulnerabilities of their own computers by setting up "tiger teams"—groups of people who were authorized to try to steal sensitive information from DOD computers. But the teams were disbanded because, it turned out, they invariably could get anything they wanted out of any computer they had access to.

Col. Roger Schell, who is deputy director of DOD's Computer Security Center in Maryland, was a member of teams set up by the Air Force. Sitting in a small barren office in a sprawling complex of buildings which are encircled by barbed wire and an electrified fence and whose doors are physically guarded, Schell explained how the tiger teams had worked. He told of an IBM 370 computer with terminals in areas where physical security was not stringent. But each authorized user had a secret password which, presumably, would prevent unauthorized persons from getting into the computer. This was an Air Force computer containing sensitive information. Tiger team members found they could easily get the entire list of passwords—all they had to do was ask the computer for it and the computer would print it out.

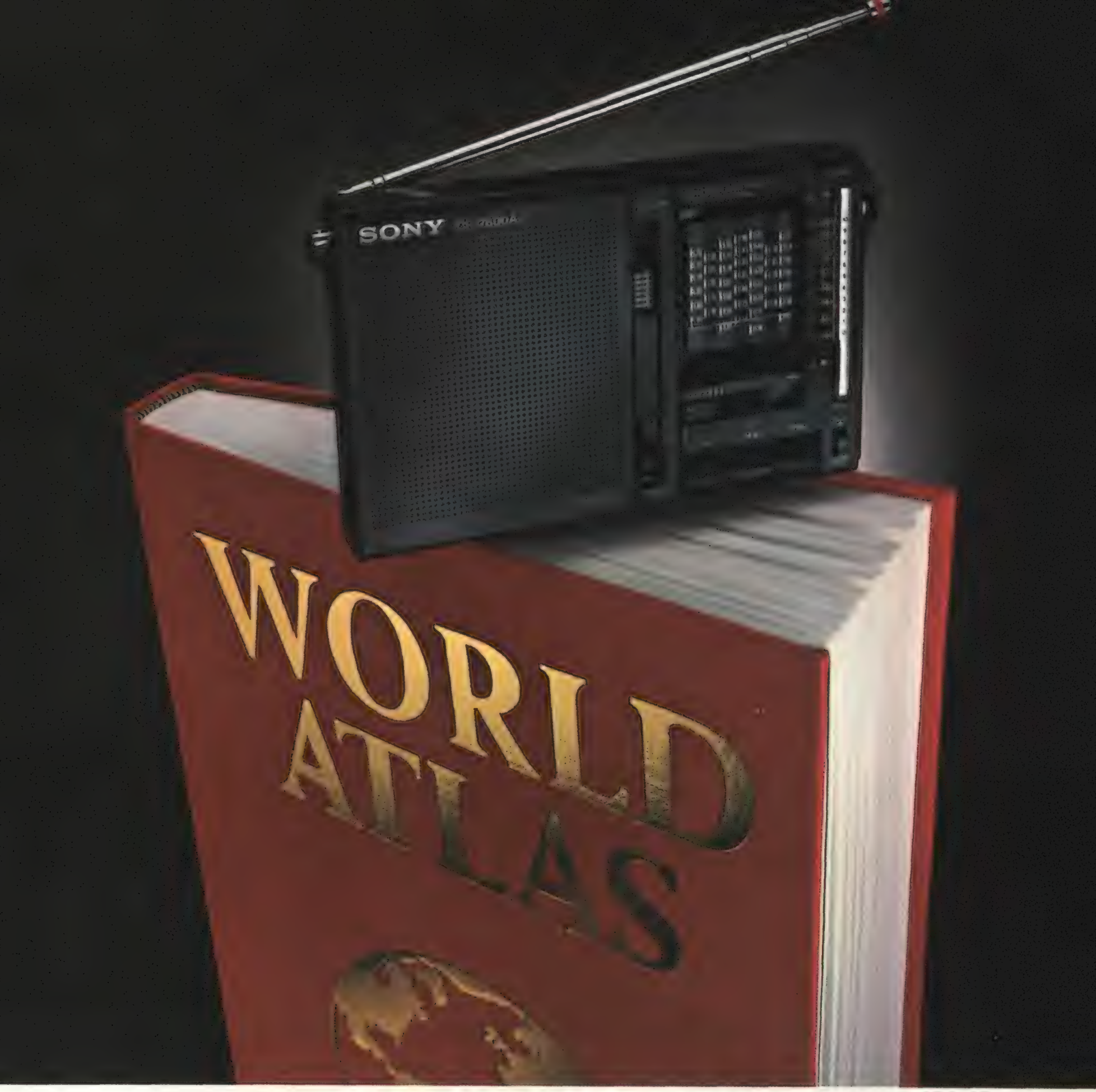
The Air Force also used Honeywell's Multics system computers, which, Schell said, "were widely touted for their security." But the tiger team found it easy to break in. For example, they learned that when a person requested information, the computer would first check the person's authorization to receive that information, then execute the request. But there was a lag between the authorization check and the execution. During that lag, the tiger team members found, they could change their request so that they were asking for information that they should not have received. The computer did not recheck their authorization for the new request.

"Some have argued," Schell said, "that a computer need not always prevent unauthorized access as long as it keeps an audit record of such accesses." The idea is that any thief could be caught in the act. The Multics system, therefore, kept a record of everyone who requested information and of what information they got. The tiger team members, however, learned that they could get into the audit record and modify it so that there was no trace of their penetration of the computer.

After the tiger team found these and other flaws in the Multics system, Honeywell developed a new Multics computer that, presumably, was secure. But, Schell said, the tiger team got in again. "The new flaw resulted from changes made to correct the previous ones." Eventually, the Air Force entered into a joint development effort with Honeywell to restructure the Multics software, resulting in a system that had a significant improvement in security and is still in use today.

For these "breaking and entering" exercises, tiger team members were allowed access to the computer but only at the minimum security level. "In order for the tiger team to operate, it needed some access to the computer but not to sensitive information," he said.

But with the tiger team members



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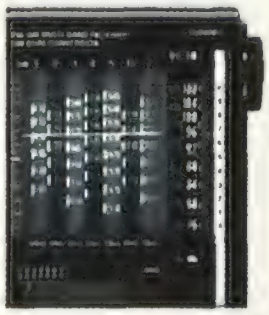

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acting like thieves over a period of weeks, didn't anyone notice or become suspicious? "There was nothing to notice," Schell explained. "We had legitimate access to the computer and we did the things people normally do —giving decks of punch cards to the computer operators and sitting at a terminal. In each instance, the occurrence of the event would not have been known if we did not tell."

Ken Thompson at Bell Labs fielded a different question: How can you break into a computer system if you *don't* have legitimate access to it? "It's easy to break in," he answered. "The first step is to find out what number to dial to reach a computer. That's usually the hardest step. But in any large computing-oriented company half of the telephone numbers are connected to a computer. You just try various combinations, or, better yet, you can get your computer to try the combinations for you." Soon, Thompson said, you will hear the beeping sound that indicates you have reached a computer.

Once a computer is on the phone, he continued, the next step is to log in—to identify yourself to the computer's satisfaction. One way to get into many systems is to try to log in to play computer games. To be friendly, many corporations allow employees and their families to play games on the company computer at night, he told me. "But it's difficult to go in absolutely cold. Usually you have a toehold—you've gotten a password from an ex-employee or you know how to get into one computer that dials into another."

After logging in, Thompson said, "you can find another computer that this one talks to. It's the domino theory. Each computer tells you the numbers to get into another. In a matter of hours, I can probably get the numbers of any networks in the country that I'm interested in."

Thompson gave me a specific example of a time several years ago when, just for the challenge, he broke

into a computer system. The system was connected to the ARPANET, a computer network administered by ARPA, DOD's Advanced Research Projects Agency. "There was a set of computers under ARPA contract," he related. "These machines were in sensitive places and administered by a single group. In my dealings with the ARPANET, this group stood out as resisting casual attack. Obviously, it was a key system that maintained other systems. I picked at it for two or three days and I got into it. Then all the other systems fell." Thompson immediately told the ARPA group of his break-in to alert them to the security flaws he discovered. The Defense Communications Agency, which is now administrator of the ARPANET, has since introduced improved access-control techniques to minimize the risk of break-ins.

Asked how he "picks at a system," Thompson replied, "It's a black art. It's not a recipe."

What Thompson and the tiger teams did certainly seem to be feasible sorts of attacks for computer criminals, but are they typical? What kinds of crimes are people most worried about? Consultants mention two broad categories. First are crimes committed by "joyriders," people who like to break into computer networks and corporate computers just for fun. (They are often teen-agers; however, cautions Ken Thompson, a large bearded man whose hair falls to shoulder length, the teen-agers shouldn't get all the blame. "There are lots of 'ex-teen-agers,'" he laughs.)

Among the youngest computer criminals ever apprehended were four 13-year-old boys at New York's Dalton School. The leader of the group was an eighth grader; his accomplices were in the ninth grade.

The Dalton boys broke into corporate computers in Canada through a commercial computer network. One of the boys had a friend whose older brother was a computer programmer and, through that friend,

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'I picked at it for a few days and got in. It's a black art. It's not a recipe'

the boys got the unlisted network numbers of various Canadian firms, including a data-systems company that did work for Pepsi-Cola. Using these numbers, the boys broke into company computers, inadvertently destroying files at a cement company (fortunately, the firm had backup files on magnetic tape) and instructing the data-systems company computer to send them ten cases of Pepsi.

The culprits were caught after their calls to the Canadian firms' computers were traced to the school telephone. The U.S. Attorney's Office in Manhattan did not press charges because the boys were so young.

Computer hackers—a term loosely used for programming enthusiasts—and the problems some of them can cause have been extensively studied by Donn Parker, a computer-crime expert at SRI International in Menlo Park, California. "You can go to any college in the United States," says Parker. "If they teach computing they will have had a long history of system hackers, some of whom go too far. It's just like drugs. You get hooked on it and can't stay away from it. Most of the kids who get arrested and convicted go back to it and some get convicted again. These kids don't discriminate between a computer to play games with and one that processes $4 billion a day."

Some experts, like FBI agent Brown, work with teen-agers to try to get them to see that breaking into computer systems is no different from breaking into any other form of private property, such as a private residence or a bank.

"In Los Angeles, Philadelphia, New York, San Francisco, these kids get together socially to discuss what they've learned about how to break into computers," Brown says. "It's almost a subculture. I've talked to teen-agers who know more about the inner workings of a telephone company than many of that company's own analysts do. Some kids actually steal information for others. Sometimes they do it on a dare and sometimes for money."

Brown remarks that there are hundreds of computerized message centers throughout the country where computer hackers talk to each other. At many computer stores, for example, a computer is "on line" (linked with other computers in the same network and ready for use) all the time. People call up these message centers, or "bulletin boards," and trade information. Most of the users are genuine hobbyists who call in to find out when the next club meeting will be held, or to list for sale some computer equipment. But there are the abusers, too. For example, a teen-ager may offer to swap a password to get into a particular system in exchange for a manual describing how another system works. "It's legal as long as it can't be proved that they are soliciting information for the commission of a crime."

It is part of Brown's job to read messages left at these bulletin boards. He points to one such computer printout, providing access codes for Sprint, a long-distance telephone service. "For those who can't stand Sprint, have a good time with these," the message reads. Another message tells how to get onto the MIT computer. He also comes across irate messages from legitimate hackers—telling the others to take their dubious activities elsewhere. "I read the bulletin boards for intelligence purposes," Brown says. "If I see evidence of crime I act accordingly. But it's rare for messages to be blatant; they know law-enforcement officials read them."

Some of these computer hackers have committed serious crimes. Last year, a Los Angeles high school student, for example, acting with several accomplices, caused a quarter-million dollars in damage at U.S. Leasing Corporation by making the company computer system collapse. The young man also admitted stealing phone-company manuals that could have allowed him to disrupt the California telephone system.

When these teen-agers do commit crimes and are caught, says Brown, their punishment is often minimal. The Los Angeles student got probation. "The kids generally get a psychiatric evaluation to see if they have sociopathic problems." Then they get probation. It isn't too helpful to put the teen-agers in detention facilities. "One of the kids went to juvenile hall. He was beat up on a regular basis. He had a baby face, was overweight, and he couldn't talk criminal talk." He didn't smoke, he didn't even swear. Often, Brown continues, all that is needed to deter the teen-agers is to make it clear to them that what they are doing is committing a crime. Many of them told Brown that it never occurred to them that there was anything wrong with breaking into computers and doing a little snooping.

An MIT senior who has logged in many hours at computer terminals agrees with Brown. Computer hacking, he says, "is a game. It's a chance to show you're clever." But, the student adds, "there's an urge to get onto these computers and a lack of knowledge of what to do when you get there. You need more knowledge than most of these kids possess to do no damage and stay on without getting caught."

A 16-year-old computer hacker who

Ringling Museums' Medieval Fair, Sarasota, Florida. Shot with an 80-200 mm zoom lens at f/5.6 at 1/125 sec

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likes to break into computer systems was asked how he regards his own behavior. Does he really think of it as innocent and harmless fun? A quiet, polite young man with soft brown hair and rosy cheeks, he began playing games on computers when he was six years old and now spends about two hours a day just fooling around on a computer. He has broken into password files, has read supposedly private computer mail, and has broken into computers that are linked together in networks. "I never told myself that there was nothing wrong with what I was doing," he said. But he continues anyway because he finds that probing the security of computers is exciting and challenging.

Many of the known adult criminals, however, are a different matter. Their motive is to commit a crime and their usual methods are to exploit gross weaknesses in computer systems with which they are intimately familiar. A crime involving data processing, for example, would most likely be committed by one of the company's data processors.

An example of "system weakness," Robert Courtney explains, would be the data-entry operation of a large corporation. A basic principle of internal-auditing controls is that the person who authorizes adding a new vendor—say, a supplier of stationery—to the system should not be the same person who authorizes payment to that vendor, because if one person did both, he could put in a fictitious vendor such as his "Uncle Harry." But the auditor may not recognize that these two people are sharing a single data-entry clerk—who may have his or her own "Uncle Harry." According to Courtney, more than 25 percent of the computer crimes over the past several years have involved this sort of finagling by female data processors who were encouraged or even tutored by male friends on the outside.

A crime falling into this general pattern took place at the Social Security Administration in Baltimore in 1980. A clerk, Janet Braintree Blair, stole at least $108,000 by a simple maneuver. Many Social Security applicants do not understand the factors used to determine the size of their initial lump-sum payments. Frequently these applicants are entitled to more than they actually receive. Blair typed into the computer a request for these additional funds, then changed the applicant's address to her own address so that the check would be sent to her. The next day, she would change back the applicant's address in the computer to what it had been originally.

Blair was caught and convicted, but in the meantime, according to a computer-security consultant, another clerk in another city was found to be doing exactly the same thing. The second woman was not prosecuted because, according to the consultant, the Social Security administrators decided it was politically too embarrassing for two such cases to be prosecuted in the same year. The consultant says of Social Security, "It's a very badly run system. Anyone can steal from it. But that's true of many systems."

Another case that never came to trial, according to the same consultant, occurred last year at an East Coast bank. The employee had stolen about $8 million by the time his activities were discovered. Over breakfast at a local restaurant, bank officials confronted the man. Look, he told them, if you prosecute me, then the details about the flaws in your data-processing system will become public knowledge—and it will cost you a lot more to fix the system than you're losing to me. The bank officials reluctantly agreed, and simply asked him to resign. "I'll keep the eight million," he said with a smile as he got up to leave, "but I'll pick up the tab for breakfast."

What can be done to prevent computer crime? Consultant Robert

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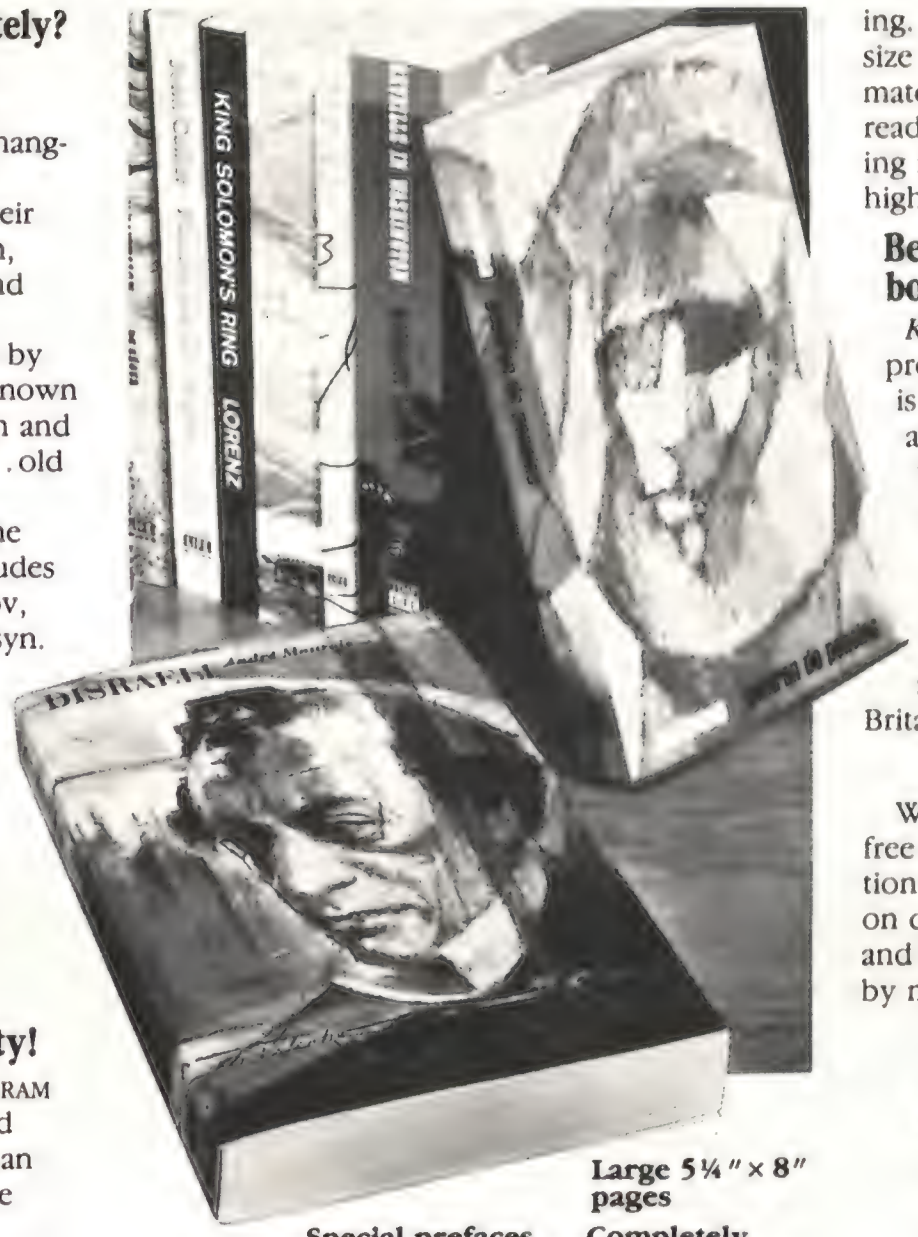

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'I'd like the problem to be more exciting, a battle of wits, but it's mundane'

Courtney emphasizes that the first thing people have to realize is that usually there is nothing technically brilliant about the crimes. "I would like the problem to be more exciting. I wish it could be a battle of wits. I wish we could fight it out at a systems-control level," he drawls. Of course, for higher security applications, the efforts for protection do need to be more sophisticated, including development of more securely designed systems and duplicate backup services to prevent total destruction of important data. Another area being developed is "encryption," in which highly sensitive data can be routinely encoded upon being entered into the computer. But the solution for the majority of situations is fairly mundane—to be more careful about physical security and good accounting practices.

Robert Morris of Bell Laboratories, who has done computer-security consulting and also has been a member of AT&T's own tiger teams, agrees. When asked how physically secure most corporations' computers are, he immediately launches into an example of the kinds of security problems he encounters.

"I was asked to consult at company X," he says. "They wanted to protect their data. I had a two-hour interview with a highly placed officer. Later, I asked for directions to the men's room and, walking down the hall, I passed a room labeled 'Message Center.' I walked in. It was a very large room. Employees were typing data into terminals. I walked around the room unescorted with no badge or identification. I looked at each terminal. I spent 10 or 15 minutes there and no one asked me who I was." In that time Morris got all the information he needed to break into the company's computers.

"Most larger outfits put on a show at the front door," Morris says. "But once you're in, you're in. If you can get a pass from a computer-servicing company as a repairman, it probably will get you in the door of most major corporations in the United States."

Thompson and Morris also speak of another type of lax security. Companies frequently send each other magnetic computer tapes. At the end of the pertinent information, the companies mark the tape. They usually do not, however, erase any information that may have been on the tape previously, so anyone who reads on after the place marked "stop" may get interesting information. For example, Thompson, who habitually reads on out of curiosity, discovered on one tape a company's highly secret protocol—"the things you have to say and listen for to talk to computers that don't talk to each other."

"Companies have to prevent careless errors as well as criminal behavior," says Robert Courtney. "Errors and omissions just tower over crime. I'm terribly anxious that people not spend enormous sums of money preventing crime when the solution to the problem is not cost-justified." His method is to find ways of making employees accountable for their work.

As an example of a system that works well, Courtney cites IBM's Advanced Administrative System, which he describes as a system that places customer orders, bills customers, and manages the employee payroll and corporate cash flow. "There are thousands and thousands of transactions and there are thousands and thousands of terminals," he says. "But each person is constrained to only the information he needs to do his job. If an employee tries to gain access to unauthorized information, not only is he turned off but the only way to turn the terminal on is for the local manager to come by and turn it on with a key."

Other ways of making computer crime more difficult are to limit the number of people with access to the computer and to use computer programs that serve as auditors by, for example, identifying instances when someone got into the company files during times when the files are normally closed. Managers also are advised to change their employees' computer passwords frequently and to choose passwords that are not easy to guess (passwords with no vowels are the most secure). The most frequent kinds of passwords are birthdays, social security numbers or a person's name, all of which are obvious and very easily guessed.

But even to plug up the obvious security leaks has a price. "There is an economic question of how much you are willing to pay," Morris says, "and there is also the question, to what extent are you going to make data inaccessible to employees? Because there will be some of that. Big organizations tend to be extremely paranoid; they also tend to be extremely blind about their own lack of security. The purpose of computer systems in the last analysis is to let you do your work. There are conflicts between that and security."

But, Thompson told me, those who really care about their computer security usually get helped. "There are two types of administrators. Some say, 'Security is so hard all you can do is give me Band-Aids.' So you give those administrators Band-Aids. Others look you straight in the eye and say, 'Our computer system is secure.' Those are the administrators we worry about."

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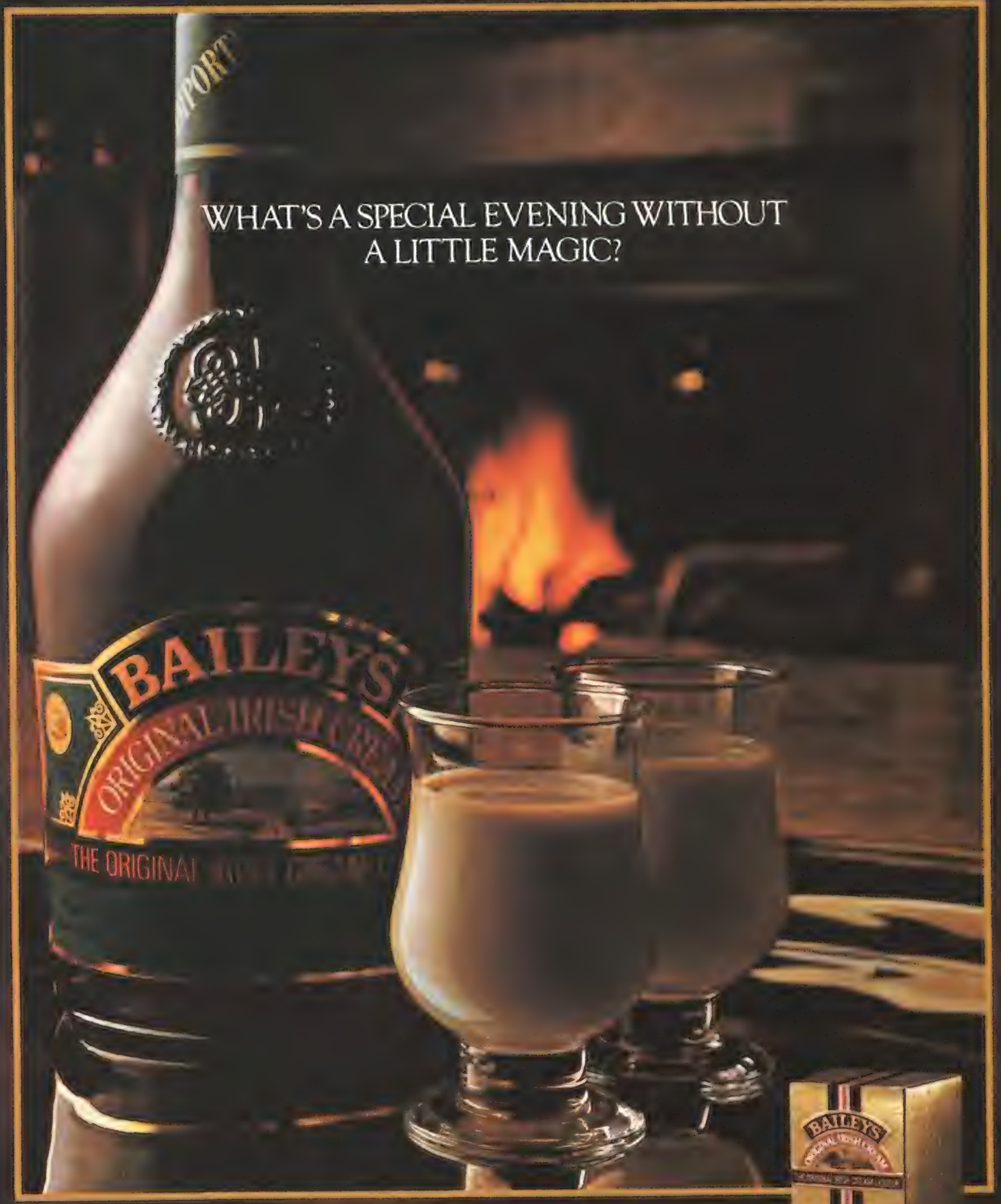

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Book Reviews

The Selected Letters of Mark Twain
Edited with an introduction and commentary by Charles Neider
Harper & Row, $16.95

Few writers, it seems, have chosen their careers less self-consciously than Mark Twain, who drifted into literature, one might say, by way of newspaper reporting. And yet, according to the evidence of even his earliest extant letters—those he wrote to his family while traveling the country and working successively as a printer, a riverboat pilot and a prospector—he was a writer from the very start, having already acquired the warm, familiar, humorous style and the comprehensive understanding of human nature that inform the work that made him famous.

His maturity of craft and vision seems all the more remarkable when one considers that there was little in the culture of his time and place, and in his family background, to encourage him and set standards of literary excellence. As Charles Neider writes in his introduction to this collection of Twain's letters: "One wonders; where did he learn it all? But of course on the whole he didn't. We are observing the unexplainable, the possession of a wondrous gift." It is one of the pleasures afforded by hindsight to see this gift in action before its possessor was fully aware, perhaps, of its existence.

The Selected Letters of Mark Twain, which covers his life from the age of 17, when he was working as a printer in New York City, to a time shortly before his death in 1910 at the age of 74, compose, as Neider says, "a second but even more intimate autobiography." As such, it complements the version of Twain's autobiography that was edited by Neider himself and published by Harper in 1959. Neider's present source is the two-volume edition of Twain's letters compiled by his friend and literary executor Albert Bigelow Paine and published, also by Harper, in 1917 (and currently reprinted by AMS Press of New York).

The selection is a generous one, representing a fairly substantial portion of the original edition. In his introduction, Neider declares that he chose letters "primarily but not exclusively for their humor, their autobiographical interest, their literary quality and the degree to which they discuss literary matters," while omitting "those which are obviously dated, which are trivial and which were half-hearted responses to fan letters," and those in which Twain "indulged his penchant for philosophical determinism . . . associated with his personal pessimism."

The standards for selection are excellent, and on the whole they are well followed. The letters chosen touch on the principal events of Twain's life, while presenting, whether as correspondents or subject matter, the people to whom he was closest, including, as a matter of course, his wife, Olivia Langdon Clemens, and his friend William Dean Howells. We can trace his gradual emergence as a writer and his growing reputation, which was established once and for all with the publication of *Innocents Abroad* in 1869. The more than ordinary run of hardships that accompanied his fame is amply documented: his bankruptcy after the failure of a typesetting machine in which he had invested heavily and, infinitely worse in his later years, the deaths of two of his daughters and Olivia herself.

For all its inclusiveness, however, the book has its flaws, being neither a completely original work nor, properly speaking, a new edition of an old one. Albert Bigelow Paine's biographical sketch of Mark Twain, preceding Neider's introduction, should have been frankly identified, if only with a line or two at the end, for what it is: Paine's own introduction to *his* edition of the letters, published in 1917. As it happens (apart from a citation on the copyright page, which cannot after all be considered as belonging to the text of the book), neither Paine nor the source of the letters is mentioned until close to the end of Neider's introduction.

Furthermore, it is a pity that Paine's commentaries to the letters had to be omitted. Unknown though he may be to most present-day readers, and so unable

Illustration by E. W. Kemble from *The Annotated Huckleberry Finn* by Michael Patrick Hearn (Clarkson N. Potter, Inc., 1981)

Twain's Huck Finn takes a rest "in the moonshine."

to carry a book under his own name, he still speaks with the authority and intimacy of one who knew his subject personally, as the retained introduction shows. Neider's commentaries, while covering much of Paine's ground and adding new material as well, are sometimes a bit short on information. One would like to know more, for example, without having to consult other works, about the *Century Magazine*'s Richard Watson Gilder and publisher Frank Nelson Doubleday.

Finally, and admittedly this is a matter of opinion, Neider's discussion of Twain's humor, to which he chose to devote a large portion of his introduction, might have explored more deeply the nature of this tremendous gift by considering how it served Twain's extremely complex personality, which had its bitterly pessimistic as well as its buoyantly optimistic side. Humor for him, as for all true humorists, perhaps, was in part a defense against the cruelty of life, an alleviation of its pain. As he himself wrote in *Pudd'nhead Wilson's New Calendar*: "The secret source of Humor . . . is not joy but sorrow. There is no humor in heaven."

Richard McDougall
New York writer

Nadia Boulanger, A Life in Music
Léonie Rosenstiel
Norton, $24.95

Aaron Copland has often said, "Mlle knew *everything*!" This Mlle, at the age of 16, won the three most sought-after prizes at the Paris Conservatory: in organ, in fugue, and in accompaniment at the piano. This Mlle conducted the New York Philharmonic, the Boston Symphony and many other orchestras in an era when orchestral musicians were not accustomed to being—or willing to be—conducted by a woman.

It was this Mlle who would introduce many music lovers to the music of Monteverdi in a series of recordings that are, fortunately, still superbly preserved today. It was the Mlle who was the principal teacher not only of Aaron Copland, but also of Walter Piston, Roy Harris, Elliott Carter, Ross Lee Finney, Herbert Elwell, and so many more that she, through her "Boulangerie," was the greatest single influence on the development of American music in this century.

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she gave the author letters and papers that have never before been available to anyone, we have known almost nothing of the childhood, the family or the intense personal struggles that marked her development as she became the High Priestess of music, the superlative teacher the world knew in her later years.

To many readers Léonie Rosenstiel's detailed account of Nadia's early years will be at once startling and a clear guide to the woman so well known to musicians of the past half-century. From her earliest years she was dressed in boys' clothing, tied to a chair in order to insure that she would sit bolt upright and told, always, no matter how incredible her achievements in music, that what she accomplished was "not enough."

By the time Mlle Boulanger's fame had

Nadia Boulanger in 1934, a noted teacher, had just made Paris debut as conductor.

given her the stature of a supreme teacher of every aspect of music, she had been through her years of trial—both in Paris, where prizes and faculty appointments eluded her for years, and in this country, where, during one rehearsal with musicians from the New York Philharmonic, concertmaster Michel Piastro sat in his chair and played a barn-dance tune while she was conducting the Fauré *Requiem*.

The author has provided us with an invaluable portrait of Nadia Boulanger, one that tells of her enshrinement of her sister, Lili, who won the Prix de Rome that Nadia never attained, and whose

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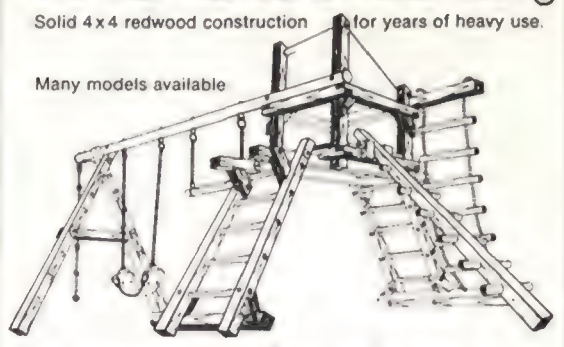

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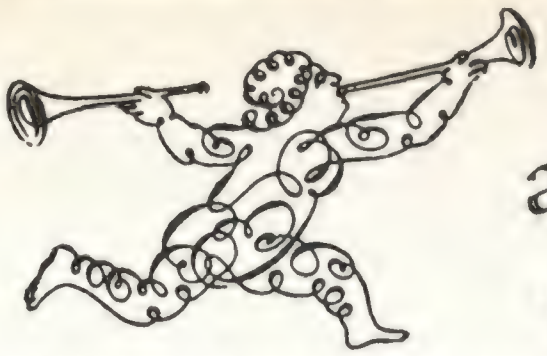
gifts as a composer Nadia always placed far above her own. Léonie Rosenstiel, by listing, and in some cases describing, Nadia's compositions, makes us want to hear some of them, for they must have more than mere merit.

We also see why Nadia dealt with her students as she did—dictatorially to the point of alienating some who would not or could not give themselves entirely into her hands. Like many teachers, Nadia wanted to govern their personal lives as fully as she dominated their musical training. She asked her married women students about their practice of birth control and insisted that those who were single should stay that way, maintaining that it was impossible to combine marriage and a career. Rosenstiel raises the question of whether Nadia's relationship with the French pianist Raoul Pugno ever progressed beyond the bounds of musical and personal admiration, which with Pugno was the usual progression. (It seems unlikely.) The author reports friendly speculation that Stravinsky might better have married Nadia than Vera Sudeikin, who became the second Madame Stravinsky.

The suggestion is not as far-fetched as you might think if you did not know that Boulanger's mother was Russian, or if you were not aware of Boulanger's intimate knowledge of every note of music Stravinsky wrote. Or that she wrote many distinguished columns of music criticism. Or that she was one of the most complex and fascinating and powerful personalities in the world of 20th-century music from World War I until her death in 1979.

On her 92nd birthday, Leonard Bernstein visited with Boulanger, whom he had known since 1946. On that September day in 1979, Bernstein told me, he asked Nadia, "Do you hear music now?" The frail, dying woman answered not of the Monteverdi or Bach or Stravinsky that Bernstein had thought she might name. "Oh yes," she said, "I hear a music that has no beginning—and no end. *Sans commencement et sans fin.*" "I knew then," Bernstein said, "that she had already crossed over." From Léonie Rosenstiel's affectionate but honest portrait it seems very probable that Nadia is up there taking over rehearsals when Bach, Mozart, Handel and Stravinsky ask for time off.

Paul Hume
Music editor emeritus
Washington Post



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WESTERN NORTH CAROLINA

The Garden of Eden: The Botanic Garden and the Re-Creation of Paradise
John Prest
Yale University Press, $25

The Great Public Gardens of the Eastern United States
Doris M. Stone
Pantheon Books, $12.95

> It puzzles much the sages' brains,
> Where Eden stood of yore
> Some place it in Arabia's plains,
> Some say it is no more.
>
> —Nathaniel Cotton

The quest for an extant Garden of Eden consumed the lives of many an explorer. Columbus was so sure he had found the Biblical paradise on Earth in the West Indies that he sent a converted Jew, fluent in Hebrew, Arabic and Chaldaic (the languages he thought might be spoken in Eden), to scout it out.

But less than two centuries later, Abbot Charles Stengel pointed out that nobody had ever yet found the earthly paradise, even though the whole Earth "was now known and inhabited." According to prevailing 17th-century thought, the Garden of Eden had disappeared, but it could at least be re-created, now that the long-missing floral and faunal elements were being retrieved from the New World. And so the modern botanic garden came to be born.

How and why the botanic garden was designed to realize the re-creationist dream is the subject of Oxford historian John Prest's fascinating study. "There are flowers, but it is not a flower garden. . . . There are trees, but it is not a park." What the botanic garden was meant to be, Prest explains, was an encyclopedia, "laid out in pages . . . 'set' for reference." The genesis of modern science can be glimpsed in the painstaking efforts made in amassing collections, but the collectors' motivation was more spiritual than empirical. In the confines of the reborn Eden wise men might reflect, scholars look upon the many faces of God, doctors discover the healing "physick" in the gallery of horticultural "simples."

These god-fearing gardeners sought not only to unite the world's flora, but to nurture it in the Edenic condition of "perpetual Spring and the fruitful autumn." And in far from tropical climes the growers fared surprisingly well at their impossible task. Evergreens and bulbs stretched the seasons of green and bloom, and orchardists, accomplished in the grafting craft, prolonged the fruiting. Sir William Temple could fairly claim that his 17th-century English oranges were every bit as big as those in southern France.

The sacred plantings were displayed in rigidly ordered rectangles, sectioned into quarters corresponding to the known continents. Within the sections plants were grouped into parterres, simple or geometric beds, and sometimes further divided into numbered units within family cushions, called *pulvilli*. In the middle stood a fountain, where "a man could enter into communion with what was

Stone goddess among bougainvillea graces Renaissance garden at Vizcaya in Miami.

green and full of sap, recover his innocence, and shed his fear of decay."

Padua, site of one of the preeminent gardens of the 16th century, went a step further in gathering the Earth's biota for Man's contemplation, with buildings designed to house minerals, birds and fishes. Most garden planners, however, subscribed to another school of re-creation which held that the Edenic ideal was a garden for Man, before the intrusion of

other animals, including women. Andrew Marvell described it as:

> . . . that happy Garden-state
> While man there walk'd without a mate.
> Two Paradises 'twere in one,
> To live in Paradise alone.

The dream of rediscovering the Garden of Eden in botanic collections persisted into the 18th century, when with "the fluent curve" of Capability Brown (SMITHSONIAN, August 1978), pious planters recognized that "far from being corrupted, nature was innocent." So the outside world, albeit in manicured form, was subsequently allowed to penetrate the botanic garden.

Today the notion of a new Eden on Earth seems beyond reason and outside the religious doctrine of the atonement, but as the author concludes, it was a noble ideal, which was rooted in the "sometimes ill-defined but very pervasive hope for a better world."

The loss of the botanic garden-building imperative is a modern failing that concerns botanist Doris M. Stone. "Perhaps there are no public gardens for twentieth-century living because in the collective mind gardens have low priority in view of the many demands made on the public purse."

In her unusual guide, Mrs. Stone deals not with this lack, but with the abundance of fine public gardens that benefactors from more green-minded times have left us. With the help of six noted botanists, she has selected 34 examples, from Miami's Fairchild Tropical Garden to Boston's Arnold Arboretum. She has detailed the collections, hours, prices and histories, even designed minitours of horticultural hot spots. Son Roger, a photographer, has supplied scores of black-and-white impressions and a small section of sumptuous color shots. The book's most distinctive feature is a series of inserts, 43 discourses on topics as diverse as André Le Nôtre and Tropical Rain Forests. The price, $12.95, may seem steep for a travel guide, particularly "in view of the many demands made on the public purse." But for Mrs. Stone's unique guide, the outlay is well worth it.

Don Lessem
Massachusetts naturalist and writer
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The Surface Contingent

A recent finding at the General Motors Research Laboratories has changed scientific thinking about the behavior of electrons in metal surfaces. This discovery provides a greater understanding of the fundamental physical processes involved in such surface events as adhesion, corrosion and catalysis.

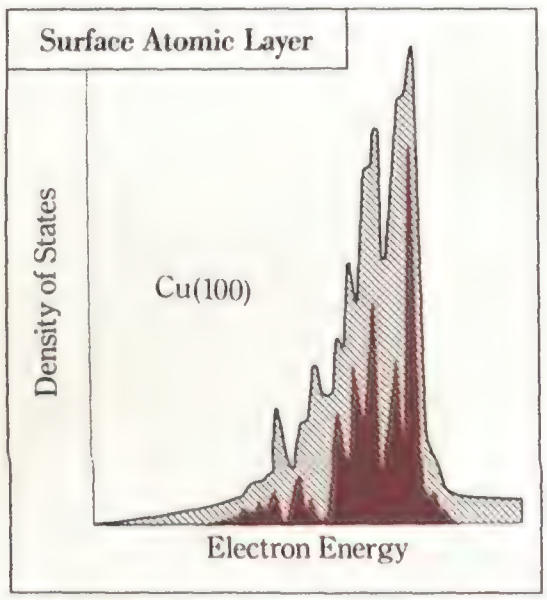

Figure 1: Energy distribution of electrons in outermost atomic layer. Red area indicates electrons in surface states.

Figure 2: Two electron density contour maps of the cross-section of a Cu(100) surface. One map shows a clean copper surface (tan); the other shows a nitrogen-covered copper surface (green).

CONVENTIONAL scientific thought treats virtually all of the valence electrons found in the surface atomic layer of a metal as if they are free to roam throughout the metal's interior. The work of three physicists at the General Motors Research Laboratories suggests otherwise. Through calculations confirmed by experimental data, the theorists have shown that more than a quarter of the valence electrons in the top atomic layer of some metals are effectively trapped in the surface. The presence of so many "surface state" electrons must be considered when analyzing physical and chemical surface phenomena, including such surface events as oxidation leading to corrosion.

Drs. John Smith, Jack Gay and Frank Arlinghaus applied their theoretical analysis to the (100) surface of five metals: copper, nickel, silver, rhodium and palladium. They made bold predictions concerning the percentage of electrons in the surface atomic layer to be found in surface states: Cu(36%), Ni(23%), Ag(23%), Rh(23%) and Pd(19%). The ratio of the red area to the hatched area of figure 1 gives the percentage for copper.

Electrons in surface states are not only abundant, but also highly localized on the surface. Chemisorption on a metal is also confined to the surface region. Figure 2 shows what happens in the case of nitrogen chemisorbed on copper. The two contour maps coincide except in the surface layer, where the interaction is largely exhibited. Localization of the interaction holds for the chemisorption of other gases, including oxygen in the initial stage of metal oxidation. These observations led the physicists to conclude that surface states are important in chemisorption.

One way to probe electrons in surfaces is to chemisorb atoms on a clean metal surface and look for changes in photoemission spectra. Such an experiment was performed at GM for fractional monolayers of nitrogen, oxygen and sulfur on Cu(100). The dominant change in the photoemission spectrum was the disappearance of a large peak whose shape and en-

ergy location was independent of the chemisorbed atom. It was of special interest that the shape and energy location of this peak was nearly identical to the envelope around the surface state peaks in figure 1. This suggests that surface state electrons play a major role in the chemisorption process.

THE THEORETICAL advance at the heart of the discovery is the "Self-Consistent Local Orbital (SCLO) Method" for solving the Schrödinger equation. This new mathematical method was devised by the GM theorists to handle the classic dilemma posed by the self-consistency requirement. The characterization of electron behavior used to complete the equation must be consistent with the behavior predicted by the equation. In other words, one almost needs to know the answer in order to make the calculation.

Self-consistent solution of the equation for a metal surface is made exceedingly difficult by the three-dimensional nature of the electron density distribution. The theorists dealt with this challenge successfully by dividing the electron density distribution into two parts—the first part due to overlapping atomic density distributions; the second part equaling the difference between this atomic contribution and the exact density distribution.

One of the more stringent tests of the accuracy of the SCLO method was an angular photoemission experiment conducted by Heimann et al. at the University of Munich, subsequent to publication of the GM research. The German research team confirmed a prominent surface state band predicted by the three GM physicists. This was the first time a surface state band on a solid had been calculated prior to its being seen experimentally. The SCLO method makes possible something that could not be done before—accurate prediction of the actual behavior of electrons whirling around nuclei at the surface of a metal.

"The large body of surface states we found on metal surfaces," says Dr. Smith, "may be a controlling factor in many physical and chemical surface phenomena. By replacing conjecture with calculation, the new surface theoretical methods give us the means to make major steps forward in the analysis of surface and interface properties."

THE MEN BEHIND THE WORK

Drs. Smith, Gay and Arlinghaus are theorists in the Physics Department at the General Motors Research Laboratories.

John Smith (center) and Jack Gay (right) received doctorates in physics; Smith from Ohio State University and Gay from the University of Florida. Frank Arlinghaus received his Ph.D. in physical chemistry from the Massachusetts Institute of Technology.

John Smith, leader of the GM solid state physics group, did postdoctoral work at the University of California in La Jolla. He joined General Motors in 1972. Frank Arlinghaus and Jack Gay joined the corporation in 1964 and 1965, respectively.

Each member of the team brings to the project a different expertise: Smith in surface physics, Gay in solid state theory, and Arlinghaus in bulk band structure calculations.

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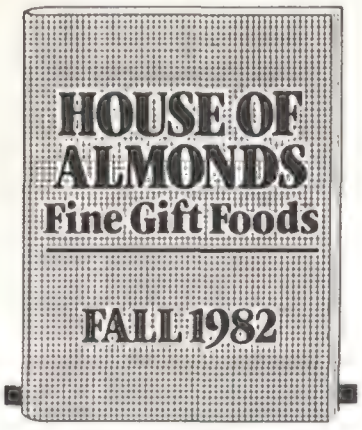

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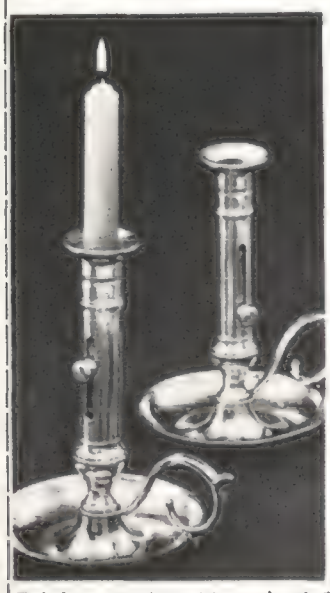

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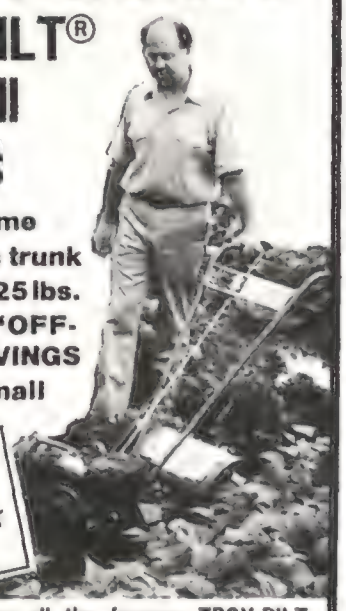

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Smithsonian highlights

August brings Raphael Soyer's slice of real life to the Hirshhorn—his own inimitable views of New Yorkers at board meetings and on the street (below), the Depression, his neighbors and friends at their everyday tasks. The exhibition, "Sixty-five Years of Printmaking," draws from a recent gift to the museum by the 82-year-old artist, who emigrated from Russia in 1912. Included are 144 works, from his first print—a 1917 portrait of his father—to his recent observations. Also displayed are 17 major paintings from the HM&SG and private collections. Both prints and paintings illustrate the artist's pervasive empathy with people and the sometimes hard business of life.

Special August exhibits and events

National Air and Space Museum
Twenty-five Years of Space Exploration New exhibit of photographs, films, artifacts traces developments since Sputnik.
Voyage of the Vikings (August 7, 9 A.M.) Monthly sky lecture recaps Mars research.
Flyer (opens August 6) Third film commissioned by NASM tells the story of a Navy pilot who goes on to restore planes and fly for the movies.
Enterprise Model (opens August 13) Detailed, 11-foot model by Stephen Henninger who spent ten years building it.
Aircraft Models New exhibit based on NASM's extraordinary collection.

Cooper-Hewitt Museum (New York)
Lace (August 3-November 7) Includes exquisite caps, trimmings and ornaments from 16th to 20th centuries.

National Museum of Natural History
Inua: Spirit World of the Bering Sea (ends January 2) Eskimo society as it was; related lecture on Alaska's ecosystems, August 13, noon.
Nature films (Fridays, noon).
Grassworks of Labrador (August 30-October 31) Baskets, mats and other works.

National Portrait Gallery
The John Stevens Family (August 6-January 20) Comprehensive collection includes models, inventions, paintings and early U.S. railroad patent.
Selections from the Photography Collection (through August 22) Portraits, Mathew Brady's glass plate negatives.

Hirshhorn Museum & Sculpture Garden
Raphael Soyer: 65 Years of Printmaking (August 5-October 3) Etchings, drypoints and lithographs.
Soyer Since 1960 (August 5-October 3) Features 17 major paintings.

Renwick Gallery
Celebration: A World of Art and Ritual (August 26-February 21, 1983) Part II of this major exhibit representing some 60 groups throughout the world; includes religious, political and agricultural objects. Part I closes June 26.

Freer Gallery of Art
Korean Art Ceramics, metalwork, paintings spanning 2,000 years.
Chinese Paintings: Recent Accessions (through summer) Thirty works.

Smithsonian events

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An Evening with Raphael Soyer (August 3, 8 P.M.) The artist in informal dialog with Hirshhorn Director Abram Lerner.
A Caribbean Gala (August 25, 7:30 P.M.) Music and dance.
Masterpieces of Irish Silver (August 23, 6 P.M.) Slide-lecture by John Teahan of the National Museum of Ireland.
Solar Challenger (August 26, 8 P.M.) Lecture by designer Paul MacCready.
Animal Life "Down Under" (August 5, 8 P.M.) Lecture by W. D. L. Ride.

At the Hirshhorn: Raphael Soyer's oil, *Farewell to Lincoln Square*, 1959

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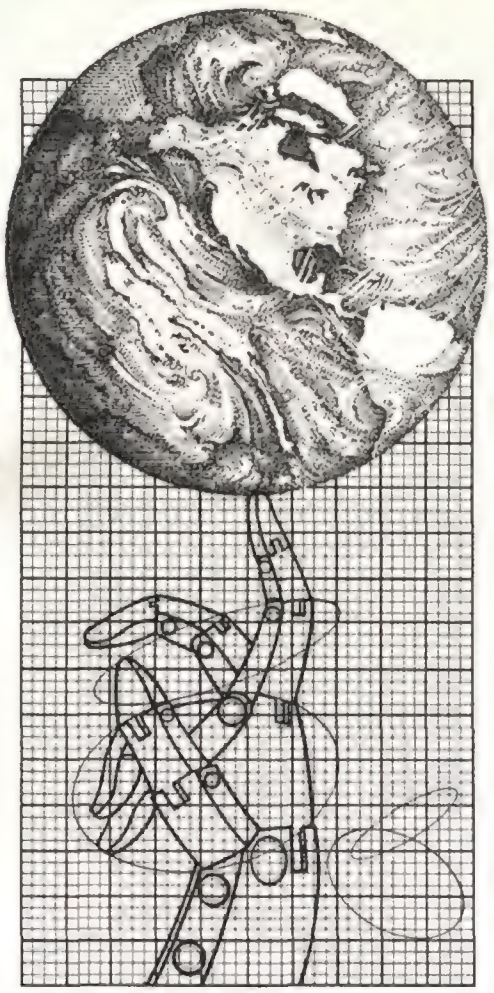

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St. Joseph, Missouri (August 21-September 19) *American Drawings III*, Albrecht Art Museum.

Mount Vernon, New York (August 28-September 26) *The Image of the Black in Western Art*, Association of Community-Based Artists of Westchester.

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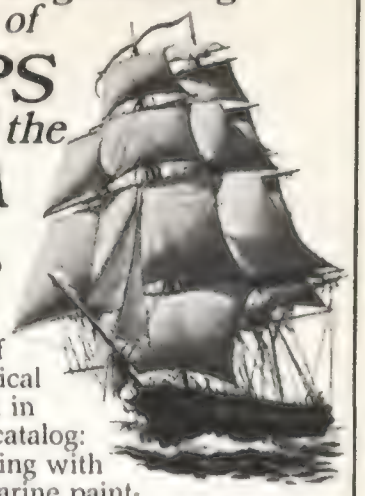

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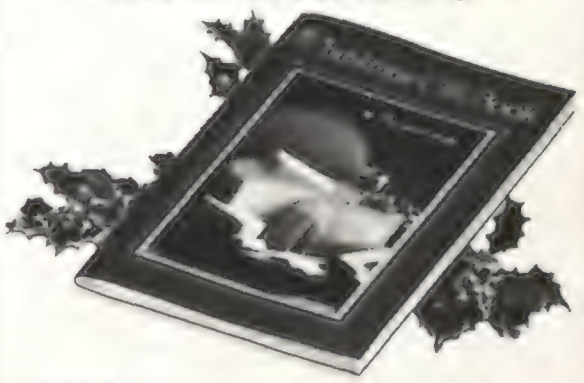

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Princes and Patriots: Flemish and Dutch Painting in the 17th Century November 14-19: Lectures and tours of the masterpieces of Rembrandt, Hals, Vermeer, Rubens, Van Dyck and other artists in the National Gallery of Art with art historian Bill Kloss.

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By Richard Wolkomir

But why would I associate with aardvarks anyway?

Lately, a nagging urge to join something has been causing me discomfort. I've learned that the malady is minor, but incurable, and permanently epidemic in this country.

Way back in 1840 the French scholar Alexis de Tocqueville noted that "Americans of all ages, all conditions, and all dispositions, constantly form associations." Since then, the ailment has intensified—by now, the United States has broken out from Maine to Oregon with more than 16,000 clubs, societies and associations, from the International Chinese Snuff Bottle Society to the Ancient Mystic Order of Bagmen of Bagdad Imperial Guild. Pretty bad.

It was when I found myself contemplating membership in the Society for the Preservation and Encouragement of Barber Shop Quartet Singing in America that I knew I had to get a grip on myself, since a tune and I are soon parted. No, I decided, I wouldn't join the first organization to flutter by, which happened to be the U.S. Association of Roller Canary Culturists. I also fought off the urge to sign up for the American Wooden Money Guild, fled from the Rough and Tumble Engineers Historical Association, and sat down to think.

Why, I asked, this yen to join? Of course, it was for chumship, the conviviality of lollygagging with one's ilk. After all, where but in the Cast Iron Implement Seat Collectors Association is a collector of cast-iron implement seats apt to find a sympathetic ear? That goes double for the Texas Barbed Wire Collectors Association. And I suspect members of the American Gourd Society have their own needs. Not to mention the North American Tiddlywinks Association. Can you imagine tugging the sleeve of a stranger in a park and brightly saying: "Care to play tiddlywinks?" And just think how lonely the Friends of Ancient Smoothing Irons would be without their club.

Leery of the yipping, roaring, quacking cacophony, I decided to eschew the Elks, Moose, Lions, Eagles, Owls and Orioles. Ditto for the Association of Old Crows, the Goldfish Society of America and the International Fancy Guppy Association, not to mention Unicorns Unanimous, Chow Chow Club and Ducks Unlimited.

But it was a shock to discover that many organizations would eschew me. For instance, the Jim Smith Society is limited to men (and women) named Jim Smith. I'll always wonder what all those Jim Smiths chin about when they get together. It was no use, I decided, even applying to Mensa, limited to people with ultrahigh IQs. And I'm ineligible for the Bald-Headed Men of America, much as I like their motto: "If you don't have it, flaunt it."

My problem was finding a group whose interests matched mine. That eliminated the Studebaker Drivers Club, the Edsel Owners Club and the International Baton Twirling Association of America and Abroad. I considered the Jane Austen Society of North America, but couldn't imagine chats on issues like "Who gave Fanny the necklaces she wore to the ball?"

Some organizations looked suspicious. For instance, what do they do at the American Association of Aardvark Aficionados, besides sponsoring the annual Miss American Aardvark Contest? And why is there a rival organization, the National Association for the Advancement of Aardvarks in America? On the other hand, what they do at the Society of Dirty Old Men seemed perfectly clear, and I wanted none of it!

But the Old Sleepy Eye Collectors Club of America left me perplexed. And the National Organization Taunting Safety and Fairness Everywhere was downright alarming to me.

I decided to look into groups I could understand, like the Sons of the Whiskey Rebellion. I'm afraid I staggered past the Cola Clan and the no-longer extant Milkbottles Only Organization (MOO).

Desperate now, I almost joined the National Association for Outlaw and Lawman History, a trigger-happy bunch if I ever saw one. Nearly run down by the Curved Dash Olds Owners Club, I was ready for the quiet of the Man Will Never Fly Memorial Society Internationale. But then I found that their motto is "Birds fly, men drink." And I'd already had enough, thank you.

Could it be, I wondered, that I'm one of those arid souls with no particular enthusiasms? At that point the Dull Men's Club looked mighty tempting, with their motto: "We're out of it and proud of it." But I suspected their meetings would be tedious. I considered joining the Procrastinators Club of America, but never did get around to it.

Now I'm running a pretty high joiner's fever. And unless something happens soon, I'm afraid I may try for the International Order of Hoo-Hoo. Can anyone help me before it's too late?

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